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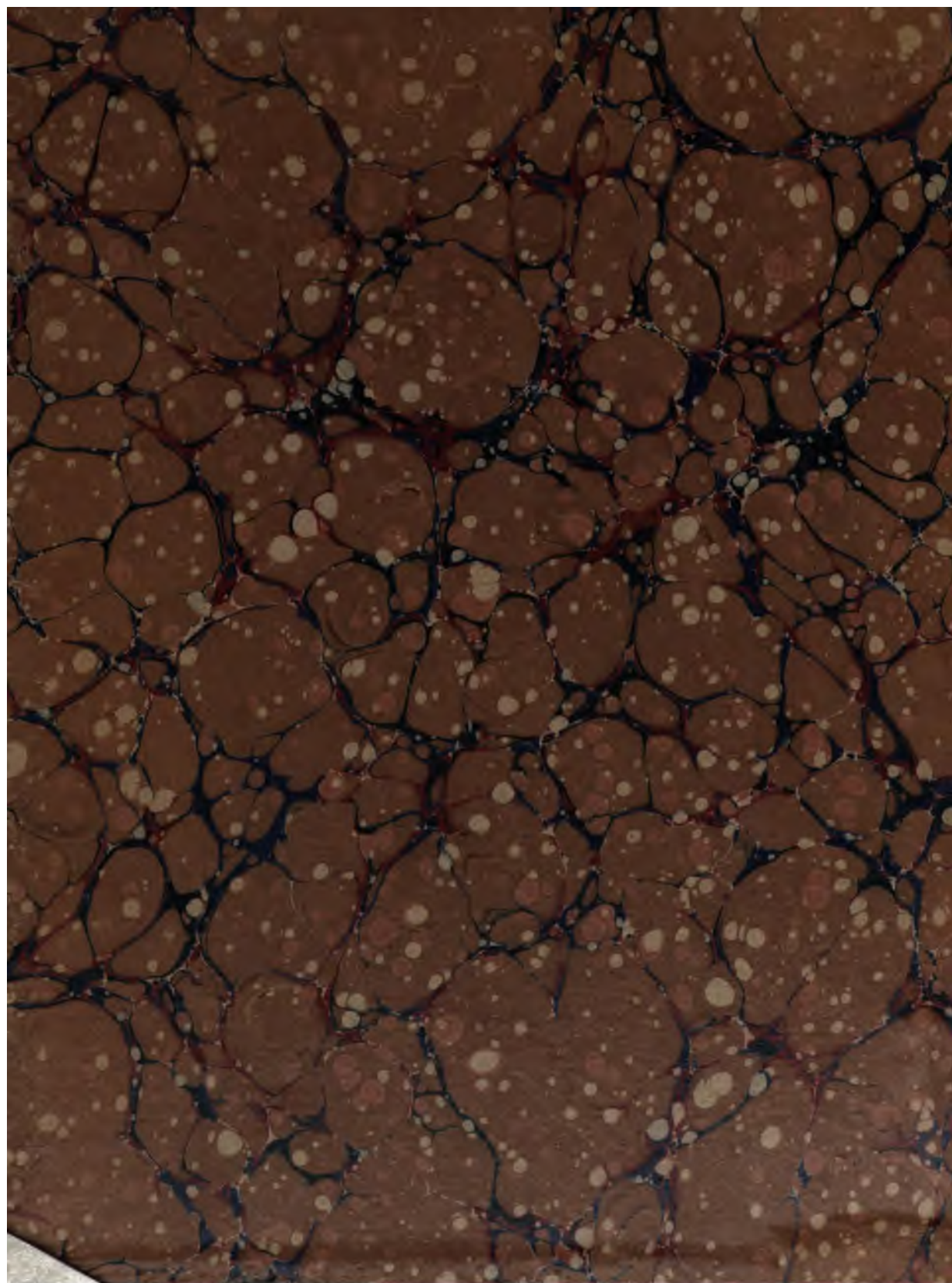
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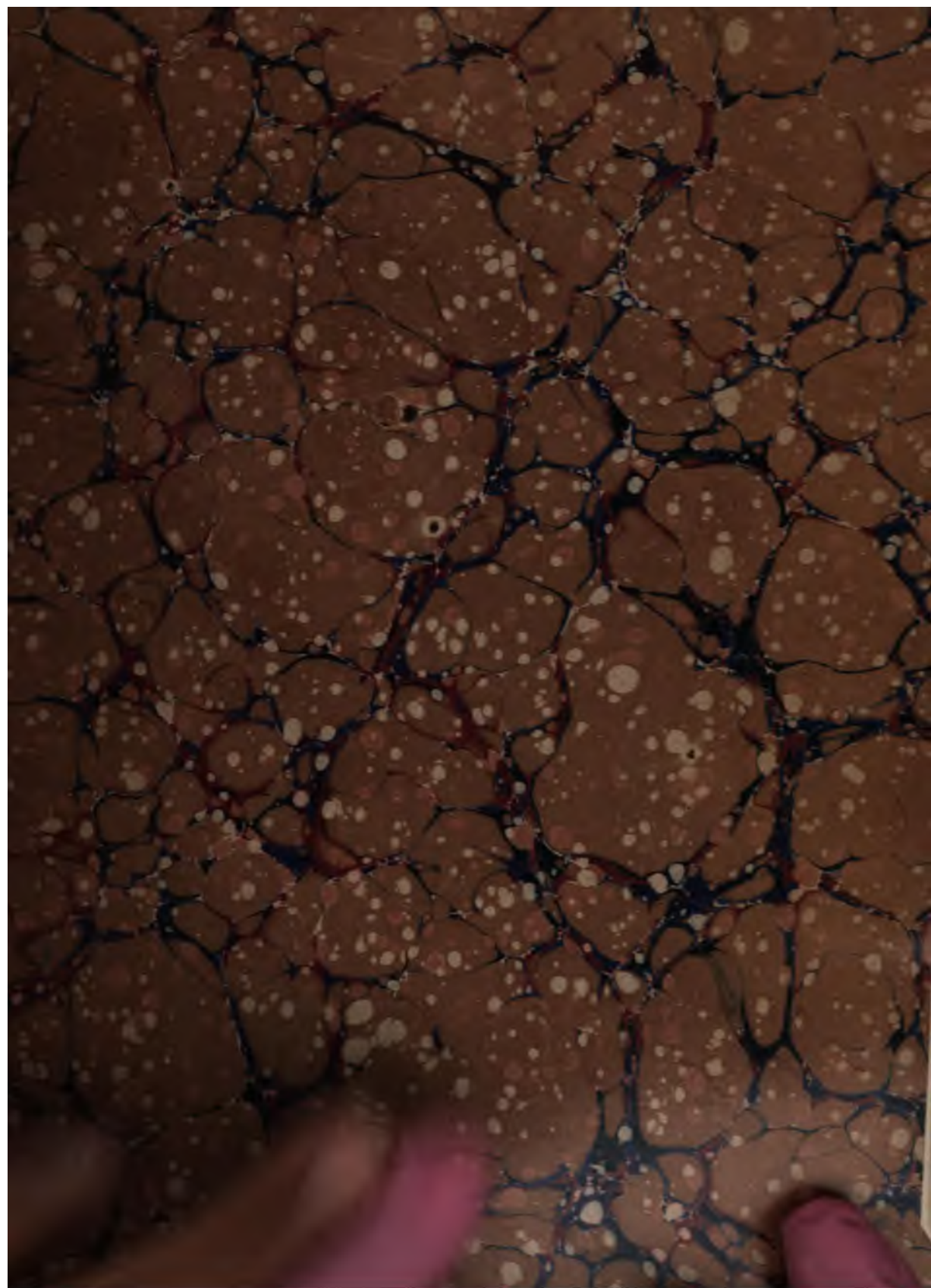
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PROCEEDINGS

OF THE

Academy of Natural Sciences

OF

✓  
PHILADELPHIA

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VOLUME LVIII

PART I. JANUARY, FEBRUARY, MARCH AND APRIL

1906

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THE ACADEMY OF NATURAL SCIENCES

OF

PHILADELPHIA

1906

PUBLICATION COMMITTEE.

HENRY SKINNER, M.D.,                      PHILIP P. CALVERT, Ph.D.,

HENRY A. PILSBRY, Sc.D.,              WITMER STONE.

EDWARD J. NOLAN, M.D.,

*The President*, SAMUEL G. DIXON, M.D., *ex-officio*.

EDITOR: EDWARD J. NOLAN, M.D.



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VOLUME LVIII

1906

PHILADELPHIA :

THE ACADEMY OF NATURAL SCIENCES

LOGAN SQUARE

1906-1907

THE ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA,  
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EDWARD J. NOLAN, M.D.,  
*Recording Secretary.*

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PUBLICATION COMMITTEE:

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*The President, SAMUEL G. DIXON, M.D., ex-officio.*

EDITOR: EDWARD J. NOLAN, M.D.

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1906.

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JANUARY 2.

MR. ARTHUR ERWIN BROWN, Vice-President, in the Chair.

Thirty-four persons present.

The Council reported that the following Standing Committees had been appointed to serve during the ensuing year:

FINANCE.—John Cadwalader, Edwin S. Dixon, Effingham B. Morris, Horatio C. Wood, M.D., and George Vaux, Jr., Treasurer.

PUBLICATIONS.—Henry Skinner, M.D., Henry A. Pilsbry, D.Sc., Witmer Stone, Philip P. Calvert, Ph.D., and Edward J. Nolan, M.D.

LIBRARY.—Dr. C. Newlin Peirce, Thomas A. Robinson, Thomas Biddle, Jr., M.D., Benjamin Sharp, M.D., and George Vaux, Jr.

INSTRUCTION.—Benjamin Smith Lyman, Henry A. Pilsbry, D.Sc., Charles Morris, Philip P. Calvert, Ph.D., and Dr. C. Newlin Peirce.

COMMITTEE OF COUNCIL ON BY-LAWS.—Arthur Erwin Brown, Thomas H. Fenton, M.D., John Cadwalader and Charles B. Penrose, M.D.

The Chair announced the deaths of the following:—

Charles T. Yerkes, a member, December 29, 1905.

George Bowdler Buckton, a correspondent, September 25, 1905.

J. B. Ellis, a correspondent, December 30, 1905.

MR. STEWARDSON BROWN made a communication on a botanical trip to the Bermudas taken during the last summer. (No abstract.)

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JANUARY 16.

MR. ARTHUR ERWIN BROWN, Vice-President, in the Chair.

Thirty-four persons present.

Dr. Sharp having taken the Chair, Mr. A. E. Brown made a communication on theories of evolution since Darwin. (No abstract.)

The following were elected members:

H. S. Jennings, Robert G. LeConte, M.D., and Henry Leffman, M.D.

The following was ordered to be printed:



## A NEW LITHOBIUS FROM COLORADO.

BY RALPH V. CHAMBERLIN.

*Lithobius harrietae* sp. nov.

*Diagnosis*.—Angles of the 9th, 11th, and 13th dorsal plates produced; articles of antennæ 36; ocelli 11–12 in 3 series; prosternal teeth 2–2, 3–3; spines of first legs beneath 1,3,1, of penult 1,3,3,1 with 2 claws, of anal 1,3,3,0 with 2 claws; coxal pores in 1 series, round, 4,6,6,5; length 11.5 mm.

*Description*.—Dorsum brown with a black or blackish median longitudinal stripe; head paler especially anteriorly; antennæ brown or yellowish-brown, paler distally; legs yellow; venter yellow, darkest over middle portion.

Head wider than long (85 : 78), widely truncate or slightly incurved behind, lateral margins moderately convex behind posterior end of eye patch, then converging to bases of antennæ, anterior margin of head between antennæ substraight; two furrows extending transversely between eyes concave anteriorly, the posterior one usually giving off two branches which converge caudally and meet in a point on the median line; each posterior lateral portion of head marked with one or several sharply impressed curved lines.

Ocelli arranged in an oblong patch in three series; 11 or 12 in number, 1+4,4,2(3); single ocellus large, vertically elliptical; first eye of upper row larger than others excepting the single one.

Antennæ short, consisting of 36 articles of short length, the ultimate conical, in length about equalling the two preceding together; articles in specimens examined nearly glabrous, possibly due to rubbing.

Prosternal teeth 2–2, 3–3; when 3–3 the external tooth on each side more widely separated from the median than the latter from the internal.

Angles of the 9th, 11th, and 13th dorsal plates produced; 1st and 3d scuta considerably sinuate posteriorly, 5th slightly so, 7th straight, 8th, 10th and 12th sinuate.

Spines of first legs  $\begin{smallmatrix} 0,2,2,0,0 \\ 0,1,3,1,0 \end{smallmatrix}$ ; of the penult  $\begin{smallmatrix} 1,0,3,3,1 \\ 0,1,3,3,1 \end{smallmatrix}$ , the claw with 1 spine; of the anal  $\begin{smallmatrix} 1,0,1,3,0 \\ 0,1,3,3,0 \end{smallmatrix}$ , the claw with 1 spine.

Coxal pores in 1 series, round, 4,6,6,5.

Gonopods of female with claw tripartite, the lobes rather short; basal spines 2-2, or 3-3, stout, acutely pointed above middle, the inner smallest.

Length of body 11.5 mm.; width 10th plate 1.6 mm.; length of antennæ 3.3 mm.; of anal legs 4 mm.

*Locality*.—Near Glenwood Springs, Col.

The types consist of four adults.

## FEBRUARY 6.

MR. ARTHUR ERWIN BROWN, Vice-President, in the Chair.

Fourteen persons present.

The Publication Committee reported that papers under the following titles had been presented for publication:

"Mollusca of the Southwestern States, III," by Henry A. Pilsbry (January 24).

"A New Lithobius from Canada," by Ralph V. Chamberlain (January 26).

"Some Cold-blooded Vertebrates of the Florida Keys," by Henry W. Fowler (January 29).

"Studies in South and Central American Acrididæ (Orthoptera), with the descriptions of a new genus and six new species," by James A. G. Rehn (February 2).

"Further Knowledge of some Heterognathus Fishes," by Henry W. Fowler (February 6).

MR. WITMER STONE made a communication on certain ornithologists of the past, giving incidents in the lives and commenting on the works of Catesby, William Bartram, Barton, Wilson, Charles Lucien Bonaparte, Audubon, John K. Townsend, William Gamble, John Cassin and Samuel W. Woodhouse. (No abstract.)

The Council reported that the President, Samuel G. Dixon, M.D., had been appointed to represent the Academy at the approaching celebration of the 200th anniversary of the birth of Benjamin Franklin by the American Philosophical Society.

---

FEBRUARY 20.

MR. ARTHUR ERWIN BROWN, Vice-President, in the Chair.

One hundred and six persons present.

The Publication Committee reported that a paper entitled "*Planaria morgani* n. sp.," by N. M. Stevens and A. M. Boring, had been presented for publication (February 14).

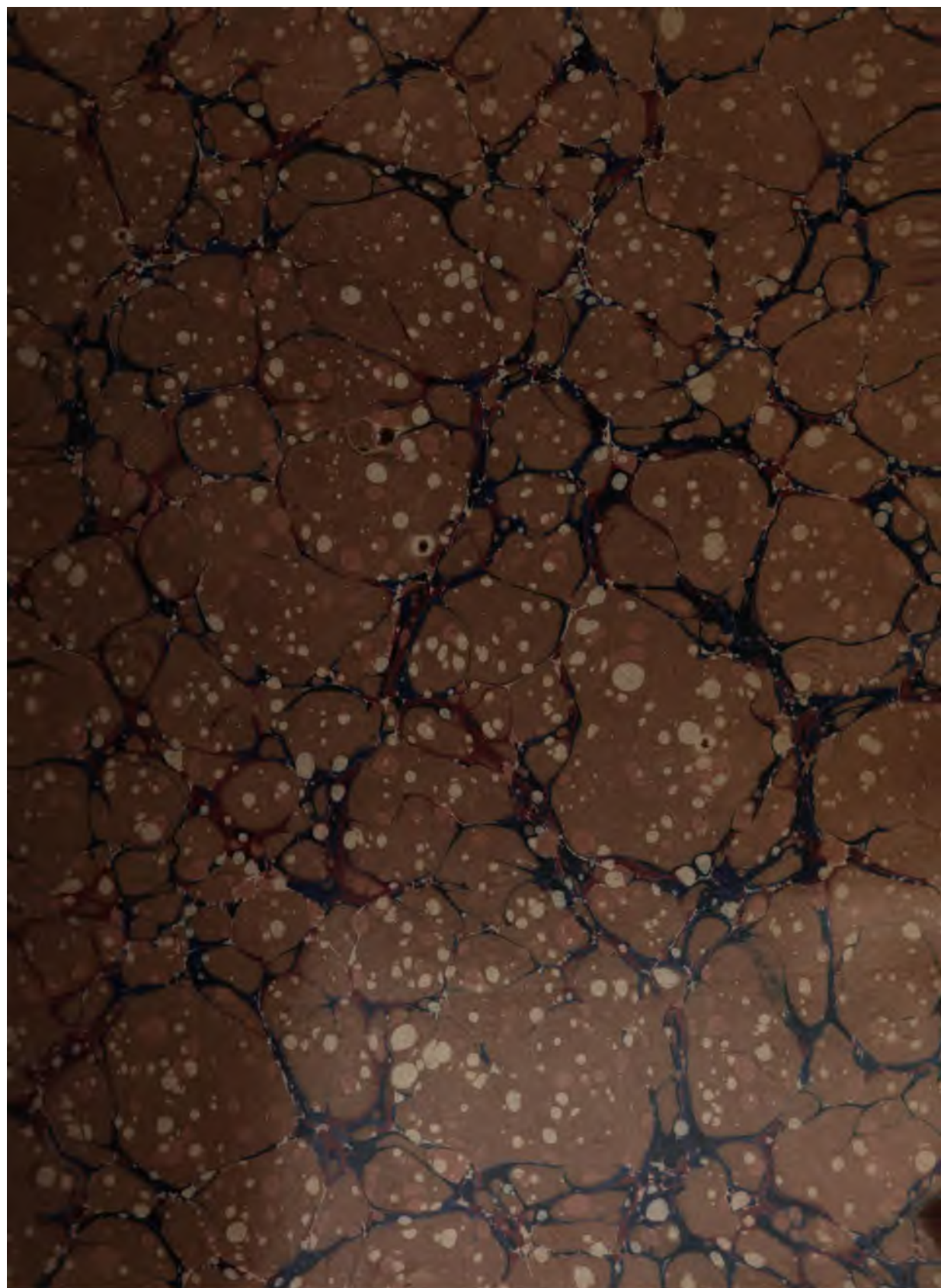
The deaths of Charles Smith, a member, March, 1905, and of John C. Wilson, a member, February 19, 1906, were announced.

MRS. CHARLES SCHAEFFER made a communication on the caves and flowers of the Cougar Valley in the Selkirks. (No abstract.)

The following were elected members:

D. H. Tennent, R. E. B. McKenny, and Edward S. Miles.

The following were ordered to be printed:



only slightly coiled, entering the anterior enlargement of the lumen of the penis nearly at right angles. Penis short and broad, nearly filling the atrium (similar to that of *P. maculata*). Uterus large, dorsal, extending forward nearly to the pharynx chamber; stalk of the uterus passing to the left side, dorsal to the vasa deferentia and oviducts, and entering the atrium laterally and ventral to the entrance of the common oviduct (Plate I, figs. 5 and 6).

*Reproduction by Fission.*—Like *Planaria maculata*, this species reproduces both sexually and asexually. Indications that fission had occurred were observed in May, 1901–1905. In May, 1905, while all the individuals in one branch of a certain stream were sexually mature and depositing egg-capsules, those in another branch of the same stream were found in all stages of fission and regeneration (Plate I, figs. 7–10). During the last week of May and first week of June a few individuals showed regenerating atrial organs. The same difference, as to sexual maturity and fission, was observed in collections from the two branches of the stream in October, and at the date of writing (February 7th) there are no sexually mature worms among the thirty to forty specimens which were reproducing by fission when brought into the laboratory in October. About half of the number have divided in the aquarium. Fission occurs at a point nearer the pharynx than in *P. maculata* (fig. 7).

*Regeneration.*—Both anterior and posterior regeneration at all levels proceeds much as in *P. simplicissima*, but both regeneration and form regulation are more rapid.

*Habitat.*—*Planaria morgani* is found on the under side of stones and dead leaves in a small stream, one branch of which flows through the Bryn Mawr College campus. The authors have not found it elsewhere.

#### EXPLANATION OF PLATE I.

- Fig. 1. Freehand sketch of living planarian, magnified five times. Atrial organs present (a). Limits of the digestive tract indicated by dotted outline.
- Fig. 2. Same of an individual without atrial organs.
- Fig. 3. Camera drawing of whole mount, showing pharynx and branches of the digestive tract. Magnification 10 diameters.
- Fig. 4. Reconstruction from camera drawings of frontal sections, showing cerebral ganglia, lateral nerve cords, cephalic nerves, eyes, and ovaries. Mag. 35 d.
- Fig. 5. Reconstruction of reproductive system from a series of frontal sections, dorsal aspect. p.=pharynx. t.=testis. od.=oviduct. v.s.=vesicula seminalis. u.=uterus. p.l.=penis lumen. pe.=penis. a.=atrium. c.o.=common oviduct. r.=reproductive pore. u.s.=uterus stalk. Mag. 10 d.









noticed and a little in the intensity of fine blackish maculations on the dorsum, a few specimens being almost free from the latter while others have a "salt and pepper" effect.

***Hyalopteryx asinus* n. sp.**

Types: ♂ and ♀; São Paulo, São Paulo (♂), Jundiahy, São Paulo (♀), Brazil. September 14, 1900 (♂), February 24, 1899 (♀). (Hempel [♂], Schrottky [♀].) [Acad. Nat. Sci. Phila.]

Allied to *H. rufipennis* Charpentier, but differing in the larger size and slenderer limbs in both sexes, and in the male in the bullate metazona, the broader, more acute tegmina, the elongate internal genicular processes of the caudal femora and the extremely elongate subgenital plate. The Bolivian *H. exaggerata* Burr is a close ally as

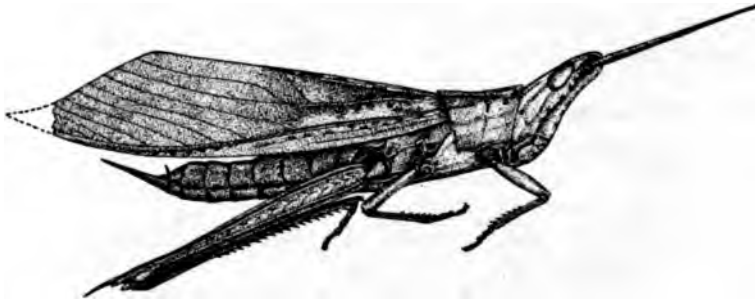


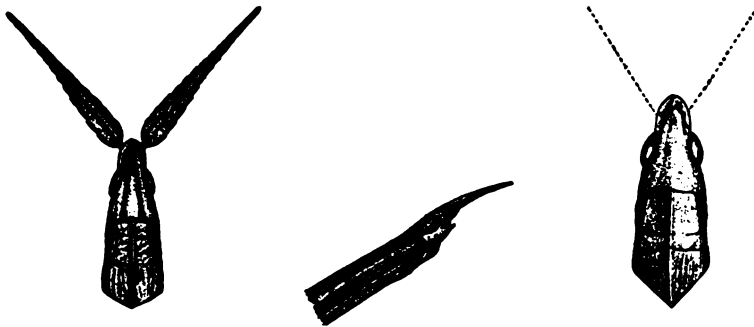
Fig. 1.—*Hyalopteryx asinus* n. sp. Lateral view of male type. ( $\times 2$ .)

shown by the genicular structures mentioned in the brief original description, but it can be separated by the yellow anal field of the wings and by inference by other characters, as the author says: "In venation and structure, this form resembles *H. rufipennis*."

Size rather large; form elongate, very distinctly compressed, greatly so in the male; surface rugulose and covered with scattered whitish hairs, both the character of the surface and the hairs being much more pronounced in the male than the female. Head about equal to the pronotum in length in the male, distinctly shorter in the female, the occiput much more ascendent in the male than in the female; fastigium projecting beyond the eyes a distance equal to the width at the cephalic margin of the eyes, lateral margins parallel in the male, slightly converging in the female, the apex with a rounded angle, lateral sections more distinctly depressed and the short medial carina more apparent in the female than in the male; face very strongly retreating in the male, slightly less in the female; frontal costa narrow, moderately

excavated dorsad and mesad, very strongly compressed dorsad, slightly broader and parallel to the ocellus, gently but regularly diverging to the clypeus, the margins in the male all more or less sinuate; antennæ of the male distinctly but not greatly exceeding the head and pronotum in length, strongly ensiform, depressed, greatest width not contained more than seven times in length, the proximal section slender and the apex acute; eyes elongate subovoid, much more acute cephalad in the female than in the male, the infraocular sulcus slightly greater than the length of the eye in both sexes.

Pronotum of the male distinctly, but not very greatly, expanded and sub-bullate on the metazona, of the female with the metazona but very slightly broader than the prozona, the lateral carinæ slightly and regularly expanding caudad; cephalic margin subtruncate, caudal margin obtuse-angulate in the male, obtuse in the female but with the angle more acute and the side margins subemarginate; median carina distinct in both sexes, but apparently more prominent in the female than in the male; lateral carinæ of the male parallel on the cephalic portion of the prozona and following the "shoulder" on the metazona; prozona equal to the length of the metazona in the male,



*Hyalopteryx asinus* n. sp. Fig. 2.—Dorsal view of head and pronotum of male type. Fig. 3.—Lateral view of genicular region of caudal femur of male type. Fig. 4.—Dorsal view of head and pronotum of female type. ( $\times 2$ .)

very slightly shorter in the female; metazona in the male with the dorsal rugæ broken, irregular, and not strictly longitudinal, in the female more regular than in the male but not strongly marked; lateral lobes with the dorsal length very considerably greater than the depth, cephalic and caudal margins converging except for a short parallel ventral section, the ventral margin sinuate-oblique. Tegmina of the male broad, the greatest width about a fourth the distance from the

apex and contained slightly less than four times in the length; costal margin moderately arcuate, apex acute, the sutural margin straight with the apical fourth obtusely deflected to the apex, which considerably exceeds the tip of the subgenital plate. Tegmina of the female lanceolate, exceeding the tips of the caudal femora by about the length of the head, greatest width about a third the distance from the apex, which is acute; greatest width contained about six and a half times in the length; costal margin arcuate distad, the sutural margin straight for about four-fifths the length, the apical fifth obliquely deflected to the apex. Wing of the male very nearly two-thirds the length of the tegmen; costal margin strongly arcuate, the apex rectangulate; hyaline ulnar area with the width contained about two and a half times in the width of the entire wing, complete transverse veins eight in number. Interspace between the mesosternal lobes very distinctly longitudinal in the male, subquadrate in the female; interspace between the metasternal lobes narrow, slightly longitudinal in the male, transverse quadrate in the female. Abdomen more distinctly compressed in the male than in the female; male subgenital plate enormously produced, compressed, the apical section needle-like, the length equal to that of the pronotum.

Cephalic and median limbs slender, femora very slightly arcuate in the male. Caudal femora very slender and elongate, the greatest width in the male being about nine times in the length, about eight and a half in the female, exceeding the tip of the subgenital plate proximal portion hardly inflated, but almost regularly tapering to the apex, carinae distinct, pattern of the pagina distinct, acute-angulate and but shallowly impressed, genicular lobes in both sexes produced, the dorsal angles of the genicular region produced into broad, somewhat flattened, acute-angulate processes, in the male that of the internal face over twice the length of the external and as long as the femoral depth, in the female the processes of the two sides subequal; caudal tibiae slender, very slightly shorter than the femur, lateral margins with seventeen to eighteen spines in the male, nineteen in the female; tarsi with rather small arolia.

General color dorsad russet sprinkled and washed with mummy brown, ventral color pale cinnamon. Head in the male with the carinae spotted with mummy brown and two rather faint postocular lines of the same color present; eyes in the male mars brown, in the female vandyke brown. Pronotum with a pair of irregular dark bars on the lateral carinae. Tegmina in the male liberally sprinkled with small mummy brown and bistre maculations. Wings with the costal margin

of the hyaline ulnar area and the cross veins of the same canary yellow, the costal section of the wing wood brown clouded with vandyke brown; anal field proximad rather pale scarlet, distal section smoky hyaline, between the two a very distinct and moderately broad bar of hazel. Caudal limbs of the general color of the ventral surface.

*Measurements.*

	♂	♀
Length of body, . . . . .	31.2 mm.	37.5 mm.
Length of pronotum, . . . . .	5.5 "	7.5 "
Length of tegmen, . . . . .	27 "	34.5 "
Greatest width of tegmen, . . . . .	7 "	5.1 "
Length of caudal femur, . . . . .	18.3 "	22 "

A paratypic series of three males has been examined in addition to the type. One is from Jundiahy (Schrottky), and the others from São Paulo (September 14, 1900; Hempel). These specimens do not differ appreciably except very slightly in color and in the slightly greater size of the Jundiahy male.

**EUTRYXALIS** Bruner.

1900. *Eutryxalis* Bruner, Acc. Gen. and Spec. Locusts Argent., pp. 22, 24.

Included *Metaleptea minor* Bruner (not of Giglio-Tos) and *Eutryxalis strigata* Bruner, of which the former (= *Hyalopteryx gracilis* Giglio-Tos) is the type.

This genus is closely related to *Hyalopteryx*, but differs in the characters given under that genus.

***Eutryxalis gracilis*** (Giglio-Tos).

1897. *H[yalopteryx] gracilis* Giglio-Tos, Bollett. Mus. Zool. ed Anat. Comp. Torino, XII, No. 302, p. 22. [San Lorenzo, Jujuy, Argentina; Caiza, Bolivian Chaco.]

1900. *Eutryxalis minor* Bruner, Acc. Genera and Spec. Locusts Argent. p. 24. (Not *Metaleptea minor* Giglio-Tos.) [Argentina; common throughout the provinces north of the Rio Colorado.]

Sapucay, Paraguay. February 10-15, March 2-10, 1905. Seven ♂♂, ten ♀♀. [Foster, Hebard Coll.]

These specimens are quite uniform in size, and in color have the browns and greens distributed in the bicolored individuals as seen in *Truxalis*. No uniform brown specimen has been examined.

The possession of two males and three females of this species from Carcaraña, Argentina, received from Prof. Bruner and labelled *Eutryxalis minor* Giglio-Tos, enabled the author to clear up a rather unfortunate and complicated question of misidentification. A male and female

specimen of *Metaleptea minor* Giglio-Tos, received through Dr. Borelli (the collector of the types) from the Turin Museum, show that the species really is an *Orphula* and not closely related to *Truxalis* (*Metaleptea* Bruner), while the specimens determined by Bruner really are *Hyalopteryx gracilis*, answering the description very well. The species is quite distinct from *Hyalopteryx* and well worthy of generic separation.

From the known records this species appears to be distributed over a large area, extending from Caiza in the Bolivian Chaco to the Rio Colorado, and east to the Paraguay river region.

#### TRUXALIS Fabricius.

*Truxalis brevisornis* (Johansson).

Bartica, British Guiana. May 25, 1901. ♂ ♀. (Crew, A. N. S. P.) São Paulo, Brazil. September 7 and 14, 1900. 4 ♂♂, 2 ♀♀. (Hempel, A. N. S. P.) Jundiáhy, Brazil. ♀. (Schrottky, A. N. S. P.) Corumbá, Brazil (lowland). March. 5 ♂♂. (H. H. Smith, U. S. N. M.) Sapucay, Paraguay. February 10-17, March 2-21, 1905. 10 ♂♂, 17 ♀♀. (Foster, Hebard Coll.)

This series presents examples of all the color phases noticed in this widely distributed species.

Records for this species include Buenos Ayres and San Lorenzo, Argentina, Villa Rica and Asuncion, Paraguay, and Caiza, Bolivia, as well as numerous localities north of Brazil. Bruner says it is "found throughout the Republic [Argentine] north of the Rio Colorado, especially along the eastern border."

#### ORPHULA Stål.

1873. *Orphula* Stål, *Recessio Orthopterorum*, I, p. 105.

Included *papana* (Stål), *viridis* (Stål), *intricata* Stål and *punctata* (De Geer), of which *papana* has been selected as the type by Giglio-Tos.<sup>2</sup>

*Orphula papana* (Stål).

1900. *Gomphocerius* (*Hyalopteryx*) *papana* Stål, *Konunga Svenska Fregatt. Expeditions Resa. Beret. I. Ins.*, p. 330. [Rio Janeiro, Brazil.]

São Paulo, Brazil. September 1 and 5, 1900. 2 ♂♂. (Hempel, A. N. S. P.) Chapada, Brazil. April. 2 ♂♂, 1 ♀. (H. H. Smith, U. S. N. M.) Corumbá, Brazil (lowland and highland). March. 2 ♂♂. (H. H. Smith, U. S. N. M.) Sapucay, Paraguay. February 4-15.

<sup>2</sup> *Ann. Amer. Mus. Nat. Hist.*, p. 25, 1900.

<sup>3</sup> *Stål's Mus. Res. Amer. Comp. Terrat.*, IX, No. 154, p. 4.

March 6-19, 1905. 7 ♂♂, 10 ♀♀. (Foster, Hebard Coll.) Asuncion, Paraguay. 2 ♂♂, 2 ♀♀. (A. N. S. P.)

The specimens from Corumbá are slightly larger than individuals of the same sex from the other localities. Considerable variation also exists in the form of the fastigium, the ♀ from Chapada having it rather broad, but otherwise inseparable, while one individual from Sapucay has the same portion more acute than usual, in a considerable measure approaching *O. minor*. The tips of the tegmina are sharper and more acute in individuals from Chapada, Corumbá and São Paulo than in Asuncion specimens, but the series from Sapucay includes practically both extremes. Some specimens have the dorsal dark lines absent and the coloration but little varied.

The species has previously been recorded from Santos, Brazil, Formosa and Resistencia nel Chaco, Argentina.

***Orphula minor* (Giglio-Tos).<sup>4</sup>**

1897. *M[etaleptea] minor* Giglio-Tos, Bollett. Mus. Zool. Anat. Comp. Torino, XII, No. 302, p. 23. [San Lorenzo, Jujuy, Argentina; Caiza and Aguiarrenda, Bolivian Chaco.]

Caiza, Bolivia. (Borelli, A. N. S. P.) One ♂.

Chaco. (Borelli, A. N. S. P.) One ♀.

These authentic specimens, received from the Turin Museum, show that the species is a member of the genus *Orphula* and closely related to *O. pagana*. From the latter species it differs in the slenderer head, with less prominent and somewhat longer eyes, and the more acute fastigium.

**MERMIRIÆ.**

***SYRBULA* Stål.**

The genus *Syrbula* presents two extreme types, one represented by *admirabilis*, and the other by *montezuma* and *eslavæ*. These extremes might with justice be separated, as has provisionally been done by the author (*i.e.*, subgenus *Herus*), but for the presence of a type like *S. acuticornis*, which is clearly an annectant form.

***Syrbula monteruma* (Saussure).**

The specimens from Cuernavaca, Mexico, previously recorded by the author as *S. valida* and *eslavæ*, and from La Joya, San Luis Potosi, Mexico, are referable to this species, which is closely related to *S. esclavæ* and differs chiefly in the less constricted lateral carinæ of the pronotum.

<sup>4</sup> Bolivar's *Orphula jucunda* (*Actas Soc. Españ. Hist. Nat.*, XXV, p. 15) from the Rio Atalapo is probably a member of this genus, but apparently quite distinct from either *O. pagana*, with which it was originally compared, or *O. minor*.

***Syrbula esclava* Rehn.**

1900. *Syrbula esclava* Rehn, Trans. Amer. Ent. Soc., XXVII, p. 90. [Eslava, D. F., Mexico.]

1900. *Syrbula (Hesus) valida* Rehn, Ibid, p. 91. [Eslava, D. F., Mexico.]

These two names were applied to the sexes of the same species.

**AMBLYTROPIDIDÆ.****AMBLYTROPIDIA Stål.*****Amblytropidia ferruginosa* Stål.**

1873. *A[mblytropidia] ferruginosa* Stål, Recensio Orthopterorum, I, p. 107. [Brazil.]

Sapucay, Paraguay. December 19 and 20, 1901. April 30, 1902. February 13-27, March 2-11, 1905. 9 ♂♂, 12 ♀♀. (Foster, Hebard Coll.)

These specimens are assigned here with some little doubt, as they are larger than Stål's measurement of the female type (length 25 millimeters).

The females all show more or less blackish-brown maculations on the tegmina, and the males have the caudal femora strongly rose-colored with the genicular regions blackish. In the latter respect they appear to approach the very brief characterization of *australis*, but the antennæ are longer and the general coloration rather different. The latter character is of very uncertain value in this genus, as the extremes of one species are quite different, considering *A. occidentalis* a representative form.

***Amblytropidia australis* Bruner.**

1904. *[Amblytropidia] australis* Bruner, Biol. Cent.-Amer., Orth., II, pp. 62, 64. [Argentina.]

Chapada, Brazil. April and June. 2 ♂♂, 1 ♀. (H. H. Smith, U. S. N. M.)

As the original description of this species is extremely brief, little can be gleaned from it to aid in identifying material. In the material examined the tegmen are darker near the costal margin than elsewhere, and a median dark line is present on the head and pronotum of the female and the pronotum of one male. The genicular regions are obscured with dark color in both sexes, but more strongly in the male than in the female.

The range of the species is here extended north of its previous limit, Caiza, Bolivian Chaco.

***Amblytropidia vittata* Giglio-Tos.**

1894. *A[mblytropidia] vittata* Giglio-Tos, Bollett. Mus. Zool. Anat. Comp. Torino, IX, No. 184, p. 13. [Luque, Paraguay.]



São Paulo, São Paulo, Brazil. September 1 and 7, 1900. 2 ♀ ♀.  
(Hempel, A. N. S. P.)

The coloration of these two specimens is generally similar, but one has a longitudinal pale green bar on the proximal portion of each tegmen. This specimen also has a median line on the head and pronotum quite dark, while the other individual is devoid of any striking markings.

***Amblytropidia trinitatis* Bruner.**

1904. *Amblytropidia trinitatis* Bruner, Biol. Cent-Amer., Orth., II, pp. 63, 65. [Demerara, British Guiana; Trinidad.]

Trinidad, West Indies. 1 ♂. (H. D. Chipman, through Bruner, A. N. S. P.) Venezuela. 1 ♂. A. N. S. P.

The Venezuela male is inseparable from the topotypic specimen. The range of the species is considerably extended by the Venezuela record.

***Amblytropidia auriventris* McNeill.**

1897. [*Amblytropidia*] *auriventris* McNeill, Proc. Davenport Acad. Nat. Sci., VI, p. 227. [Orizaba, Mexico.]

Atoyac, Vera Cruz, Mexico. December. 1 ♂. (Bruner, A. N. S. P.)

***Amblytropidia mysteca* (Saussure).**

The material previously recorded by the author as *A. mysteca* from Cuernavaca, Texolo, Uruapan and Patzcuaro, Mexico, has been re-examined, and in all cases represents *mysteca* as understood by Bruner.

The genus *Sinipta* Stål is a rather aberrant member of this group, chiefly differing in the depressed, subensiform antennæ, which, however, does not appear to be sufficient to remove it from association with *Amblytropidia*, some species of which have the antennæ somewhat depressed.

**ORPHULELLÆ.**

The genera generally accredited to this group are with two exceptions, *Calephorus* and *Comacris*, American. The genera examined by the author in this connection are given below, with their apparent positions as far as can be expressed in a linear arrangement.

*Calephorus* Fieber (= *Oxycoryphus* Fisher).

*Parorphula* Bruner.

*Sisantum* Bruner.

*Orphulina* Giglio-Tos.

*Orphulella* Giglio-Tos.

*Clinocephalus* Morse.

*Dichromorpha* Morse.

*Chloealtis* Harris.

*Cocytotettix* n. n. (= *Fenestra* Bruner, not of Giglio-Tos).

*Toxopterus* Bolivar.

Of these ten genera a total of thirty-six species has been examined.

Several genera like *Chloealtis* and *Toxopterus* are rather aberrant and really occupy isolated positions, that of *Chloealtis*, however, being somewhat modified by *Cocytotettix*, which is in a way a transition type. The European *Calephorus* is also somewhat removed from the nearest ally *Parorophula*, but its position appears to be in this group and its affinity is clearly with the above-mentioned genus. The relationship of *Sisantum* and *Orphulina* is close, as an examination of the type species of each shows, but, for the present at least, I have considered them distinct. The only American genus not examined is *Æonomus* Scudder, from California.

#### CALEPHORUS Fieber.

1853. *Calephorus* Fieber, Lotos, III, p. 97. May, 1853. Included *C. elegans* Fieber and *Gryllus dubius* Rambur, both equalling *Acrydium compressicornis* Latreille.

1854. *Oxycoryphus* Fischer, Orthoptera Europæa, p. 311. Type, *Acrydium compressicornis* Latreille.

This genus is mentioned merely to show its relationship to *Parorophula* from which it appears to be an offshoot. Aside from the presence of a distinct intercalary vein no character of great weight is apparent to distinguish *Calephorus* from *Parorophula*. Three females of *C. compressicornis* from France and Egypt have been examined.

#### PAROROPHULA Bruner.

1900. *Parorophula* Bruner, Acc. Gen. Spec. Locusts Argent., pp. 22, 25.

Included *P. graminea*, *pallidinota* and *strigata* Bruner, of which the first, *graminea*, can be selected as the type.

This genus appears to form a transition type between *Calephorus* and the *Sisantum-Orphulina* group.

#### *Parorophula graminea* Bruner.

1900. *P[arorophula] graminea* Bruner, Acc. Gen. Spec. Locusts Argent., p. 26. [Provinces of Buenos Aires, Santa Fe and Cordoba, Argentina.]

Carcaraña, Santa Fé, Argentina. 3 ♂♂, 3 ♀♀. (Through Lawrence Bruner, A. N. S. Phila., and U. S. N. M.)

#### SISANTUM Bruner.

1904. *Sisantum* Bruner, Biol. Cent.-Amer., Orth., II, pp. 30, 69.

Type.—*S. notochloris* Bruner.

#### *Sisantum notochloris* Bruner.

1904. *Sisantum notochloris* Bruner, Biol. Cent.-Amer., Orth., II, p. 69. [Medellin, Vera Cruz, Mexico.]

Medellin, Vera Cruz, Mexico. 1 ♂. (T. Heyde through L. Bruner, A. N. S. P.)

The genus *Sisantum* is closely related to *Orphulina*, and the two form a group intermediate between the *Calephorus-Parorphula* type and *Orphulella*.

**ORPHULINA** Giglio-Tos.

1894. *Orphulina* Giglio-Tos, Bollett. Mus. Zool. Anat. Comp. Torino, IX, No. 184, pp. 8, 9.

Type.—*O. pulchella* Giglio-Tos.

This genus can be recognized without difficulty by the characters given by Giglio-Tos. The structure of the frontal costa is quite distinctive, at least in several species.

***Orphulina pulchella*** Giglio-Tos.

1894. [*Orphulina*] *pulchella* Giglio-Tos, Bollett. Mus. Zool. Anat. Comp. Torino, IX, No. 184, p. 10. [San Pedro, Paraguay.]

Sapucay, Paraguay. March 7–11, 1905. 4 ♀♀. (Foster, Hebard Coll.)

Two of these specimens have the dorsum green or tinted with greenish, the other two being dull ochre in the same region.

***Orphulina balloui*** (Rehn).

1905. *Orphulella balloui* Rehn, Ent. News, XVI, p. 178, pl. VIII, figs. 2 and 3. [Bay Estate, Barbados, West Indies.]

This species is really a member of the genus *Orphulina* and rather closely related to *O. pulchella*. It can be separated by the blunter fastigium, which has both the dorsal and lateral aspects showing a more rounded angle, the slightly more elongate ovoid eye, the slightly less longitudinal and more quadrate interspace between the mesosternal lobes, and the different coloration. The National Museum Collection contains a single female, labelled "West Indies," collected by the U. S. Fish Commission.

***Orphulina veteratoria*** n. sp.

Types: ♂ and ♀; São Paulo, São Paulo, Brazil. September 5 (♀) and 19, 1900. (Hempel; No. 216 part.) A. N. S. P.

Allied to both *pulchella* and *balloui*, but separated from the former by the more robust form, the less compressed eyes, the slightly less pronounced expansion of the lateral carinae on the metazona and the slightly more acute fastigium. The male has the interspaces between the sternal lobes much as in *Orphulella*. From *O. balloui* it can be separated by the smaller size, more acute fastigium, the more prominent eyes and the heavier caudal femora. This species is not closely related to *O. acuta*.

Size small; form moderately robust. Head slightly shorter than the

pronotum, slightly but distinctly ascending; fastigium about as long as the width at the cephalic angle of the eye ( $\sigma^7$ ) or very considerably

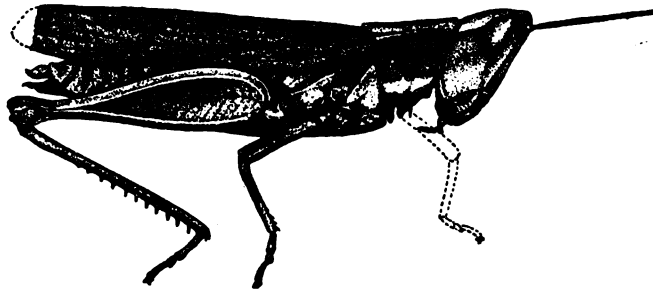


Fig. 5.—*Orphulina veteratoria* n. sp. Lateral view of female type. ( $\times 3$ .)

shorter ( $\varphi$ ), acute-angulate in the male, rectangulate in the female, an intermarginal depressed lunate area in both sexes; lateral foveolæ distinct in the female, much less distinct in the male, cephalic, elongate-



Fig. 6.—*Orphulina veteratoria* n. sp. Dorsal view of head and pronotum of female type. ( $\times 3$ .)

lanceolate; face moderately retreating with the apex rather truncate; frontal costa rather narrow, subparallel to below the ocellus, very slightly expanded between the antennæ, the margins moderately divergent ventrad, moderately sulcate from the antennæ ventrad; eyes subovate in the male, ovoid in the female, quite prominent in the male, very slightly longer than the infraocular space in both sexes; antennæ slightly longer than ( $\sigma^7$ ) or subequal to ( $\varphi$ ) the head and pronotum together, moderately depressed, slightly expanded proximad and very faintly subensiform. Pronotum with the caudal width contained about once and a half in the length; cephalic margin arcuato-truncate, caudal margin rounded obtuse-angulate; median carina distinct, lateral carinæ slightly narrowed at the second sulcus and moderately

divergent caudad in the male, subparallel to the second sulcus and very slightly divergent caudad in the female; first transverse sulcus not intersecting any of the carina, second intersecting the lateral, and the third intersecting the lateral and median carinæ, metazona slightly longer than the prozona in the male, subequal in the female; lateral lobes very distinctly longer than the depth, ventral margin with a considerable oblique cephalic emargination. Interspace between the mesosternal lobes slightly transverse in the male, and slightly longitudinal in the

female; metasternal lobes separated by a very narrow space in both sexes. Tegmina slightly exceeding the tips of the caudal femora, the caudal margin with a distinct but rather small proximal dilation, apex rotundato-truncate; intercalary vein distinct in the female, irregular in the male. Abdomen moderately compressed; subgenital plate of male blunt. Caudal femora moderately robust, considerably dilated in the proximal two-thirds, pagina rather deeply sculptured; caudal tibiae somewhat shorter than the femora, lateral margins bearing ten or eleven spines, arolia small, subtrigonal.

General color of the male bistre, the anal area of the tegmina and the dorsum of the pronotum burnt umber, the lateral angles of the pronotum ventrad and slightly mesad on the pronotum marked with black; eyes walnut brown; ventral surface buffy becoming buff-yellow on the abdomen; caudal femora ochre yellow becoming tawny, ochraceous and raw umber distad, caudal tibiae dull heliotrope purple, the spines yellowish narrowly tipped with black.

General color of female bistre becoming wood brown ventrad; dorsum of the head, pronotum and anal area of the tegmina pale apple green, the lateral carinae of the pronotum marked with blackish as in the male but more narrowly; eyes raw umber blotched with bistre.

*Measurements.*

	♂	♀
Length of body, . . . . .	14 mm.	19 mm.
Length of pronotum, . . . . .	3 "	4 "
Length of tegmen, . . . . .	12 "	15 "
Length of caudal femur, . . . . .	10 "	11.2 "

The types are the only specimens of this species which have been examined. It is possible that the sexes here described do not represent the same species, and that my association of them is erroneous. Several characters of the ♂ do not appear to be in accord with one's ideas as to what the opposite sex of the ♀ type should be, but as neither belongs to an old species of the genus I have thought best to associate them, pending the acquisition of further material. In case the sexes should prove to represent distinct species I would restrict the name *veteratoria* to the ♀.

*Orphulina acuta* n. sp.

Types: ♂ and ♀; São Paulo, São Paulo, Brazil. (Hempel; No. 216 part.) A. N. S. P.

Allied to *O. pulchella*, but a heavier species with the fastigium more acute, the eyes longer, and more compressed when viewed dorsad, the

tegmina and caudal femora shorter, the latter more robust, and the whole insect lacking the prominent lateral stripe of *O. pulchella*.

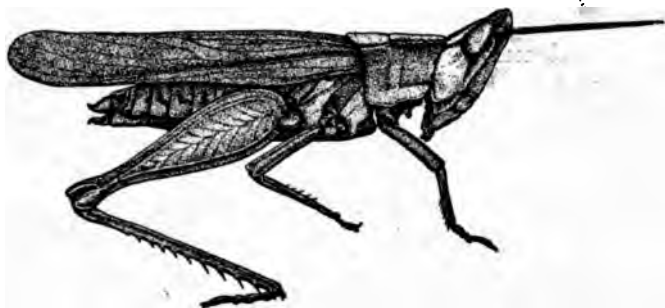


Fig. 7.—*Orphulina acuta* n. sp. Lateral view of female type. ( $\times 3$ .)

Size small; form somewhat robust, moderately compressed. Head distinctly shorter than the pronotum, considerably elevated in both sexes, the occiput more rounded in the male than in the female, the



Fig. 8.—*Orphulina acuta* n. sp. Dorsal view of head and pronotum of female type. ( $\times 3$ .)

latter having it almost straight; fastigium acute-angulate in both sexes, but slightly more so in the male than in the female, the width at the cephalic angle of the eye equal to ( $\sigma$ ) or slightly greater ( $\varphi$ ) than the length, margins distinct, a moderately depressed intermarginal area present on the dorsum, no median carina; lateral foveolæ distinct, deep, cephalic, blunt elongate-lanceolate in shape; the front dorsad forming a right angle with the fastigium, ventrad of the antennæ considerably retreating; frontal costa narrow in the male regularly but slightly expanding from the fastigium to the clypeus, deeply sulcate, particularly dorsad of the ocellus; frontal costa in the female similar to the male but subparallel from between the antennæ to the ocellus, the width being

greater and the sulcation shallower than in the male; eyes regularly ovoid in the male, acute ovoid flattened cephalad in the female, in both sexes very distinctly exceeding the infraocular sulcus in the length; antennæ slightly longer ( $\sigma$ ) or slightly shorter ( $\varphi$ ) than the length of the head and pronotum, slightly depressed and expanded proximad, being thus very slightly ensiform. Pronotum with the greatest caudal width of the dorsum contained once and a half in the length; median carina very distinct, severed in the middle, lateral carinæ

parallel to the second sulcus, considerably expanding between the second and third, very slightly expanding to the caudal margin; cephalic margin subtruncate, caudal margin obtuse-angulate, more rounded in the male than in the female; first transverse sulcus obsolete; lateral lobes of the pronotum with the dorsal length slightly greater than the depth, ventral margin with a considerable cephalic emargination. Interspace between the mesosternal lobes moderately longitudinal in the male, slightly so in the female; metasternal lobes contiguous caudad in the male, separated by a space about a fourth the width of the mesosternal interspace in the female. Tegmina considerably exceeding the tips of the caudal femora in length, apex rounded, costal margin with a very narrow and slight proximal lobe; hyaline in the proximal third; intercalary vein irregular and extending the whole length of the area, becoming lost in irregular reticulations; ulnar area with a distinct longitudinal dividing vein in both sexes. Wings ample. Abdomen considerably compressed; subgenital plate compressed with a blunt apical tubercle. Caudal femora robust, the pagina deeply and strongly sculptured; caudal tibiae distinctly, but not greatly, shorter than the femora, the lateral margins armed with ten or eleven spines; tarsi with large arolia.

General color shading from tawny-olive to burnt umber. Head and pronotum with postocular bars of vandyke brown, broad and dark in the male, quite narrow and light in the female. Dorsum of the head, pronotum and closed tegmina lighter than the lateral aspects, tawny-olive in the female, bay in the male. Venter wood brown. Limbs varying shades of the general color; tarsi very pale viridian green, with the base of the first, the whole second, the apex of the third, arolium and tips of the claws black; spines on the tibiae tipped with black.

*Measurements.*

	♂	♀
Length of body, . . . . .	14 mm.	18.5 mm.
Length of pronotum, . . . . .	3 "	4 "
Length of tegmen, . . . . .	12.5 "	16.2 "
Length of caudal femur, . . . . .	8.5 "	10.7 "

A paratypic series of two females have also been examined (September 7 and 14, 1900), and differ in no important characters from the type. One specimen represents a darker and more sooty type of coloration than the other.

**ORPHULELLA** Giglio-Tos.

1894. *Orphulella* Giglio-Tos, Bollett. Musei Zoolog. Anat. Comp. Torino, IX, No. 184, pp. 8, 10.

Included *O. gracilis* Giglio-Tos, *punctata* (De Geer), *intricata* Stål

and *elegans* Giglio-Tos. Of these *punctata* is the oldest known and the most widely distributed species, and may be considered the type.

The species of this genus are quite difficult to separate and the recognition of almost all the forms can be considered only tentative. The extent of individual variation is great, both in structure and color, and reliable characters for the separation of species are few. The work of Bruner in the *Biologia* is by far the best treatment of the genus so far published.

***Orphulella neglecta* Rehn.**

1900. *Orphulella neglecta* Rehn, Trans. Amer. Entom. Soc., XXVII, p. 94. [Orizaba, Vera Cruz, Mexico.]

Orizaba, Mexico. June. 1 ♂; type. (O. W. Barrett, A. N. S. P.)  
2 ♂♂. (Sumichrast, A. N. S. P. received through Dr. Saussure.)  
Jalapa, Mexico. August and September. 2 ♂♂. (Barrett, A. N. S. P.)  
Presidio, Mexico. June. 1 ♂. (Barrett, A. N. S. P.) Coatepec, Mexico. August. 1 ♂, 1 ♀. (Barrett, A. N. S. P.)

This series shows that the species varies somewhat in size (males from 16 to 21 millimeters in total length), but little in color. All except one ♂ from Jalapa are of the same colors, allowance being made, of course, for fading in the Sumichrast specimens, while the Jalapa exception has the usual green dorsum replaced by a dull olive tint, while the pronotum near the lateral lobes is not as distinctly marked as in the other specimens.

The ♀ specimen measures as follows: length of body, 22 mm.; length of pronotum, 4.1; length of tegmen, 17; length of caudal femur, 12.9.

This species seems to be a form limited to the Eastern Cordilleras.

***Orphulella aculeata* Rehn.**

1900. *Orphulella aculeata* Rehn, Trans. Amer. Entom. Soc., XXVII, p. 92. [Cuernavaca, Morelos, Mexico.]

Cuernavaca, Mexico. June. 1 ♂, 3 ♀♀ including types. (O. W. Barrett, A. N. S. P.)

This species appears to be quite distinct, and is not an *Orphulina* as has been thought possible by Bruner.<sup>5</sup> Superficially this form considerably resembles *O. viridescens* Scudder, but the structural characters are quite distinctive and show that no close relationship exists.

***Orphulella gracilis* Giglio-Tos.**

1894. *Orphulella gracilis* Giglio-Tos, Bollett. Mus. Zool. Anat. Comp. Torino, IX, No. 184, p. 11. [Province of San Pedro, Villa Rica and Asuncion, Paraguay.]

Sapucay, Paraguay. December 20, 1901 (one specimen). 2 ♂♂. (Foster, Hebard Coll.)

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<sup>5</sup> *Biol. Cent.-Amer.*, Orth., II, p. 74, 1904.



The validity of this species appears to be somewhat doubtful, Giglio-Tos himself<sup>6</sup> considering it a synonym of the North American *O. maculipennis* (= *pelidna* Burmeister). In this he is of course in error, but it is extremely close to *O. punctata*, which is so variable that *gracilis* may only be an extreme with the lateral carinæ more or less obliterated between the first and third transverse sulci. The form is rather more elongate, however, than in the average individual of *O. punctata*.

***Orphulella punctata* (De Geer).**

San Rafael, Vera Cruz, Mexico. ♂, ♀. (Townsend through L. Bruner, A. N. S. P.) San Marcos, Nicaragua. 2 ♀ ♀. (C. F. Baker, A. N. S. P.) Trinidad. ♂, ♀. A. N. S. P. Bartica, British Guiana. May 1-27, 1901. 23 ♂ ♂, 14 ♀ ♀. (Crew, A. N. S. P.) São Paulo, Brazil. September 1-19, 1900. 5 ♂ ♂, 5 ♀ ♀. (Hempel, A. N. S. P.) Sapucay, Paraguay. February 3-27, March 6-12, 1905. 10 ♂ ♂, 22 ♀ ♀. (Foster, Hebard Coll.)

This large series of specimens, representing a very considerable range, I find cannot be divided into species on any one or number of the innumerable characters of variation exhibited. The green and brown phases of coloration, varied with maculations and distinct bars or uniform with practically no markings, and variations in the shape and strength of the lateral carinæ of the pronotum, in the length of the tegmina and wings, in the form of the fastigium and eyes, some slight, others pronounced, are all present, and on superficial examination would appear to furnish good characters for dividing the series. Attempts along these lines, however, soon show how hopeless it would be to erect species on even the most striking types, as intermediates are present to connect them with any other extreme.

Two specimens from Gualaquiza and Valle del Lamora, Ecuador, received from the Turin Museum, labelled "*Orphula olivacea*" and recorded as such by Giglio-Tos,<sup>7</sup> are provisionally referred to this species. They are clearly not *O. olivacea*, as comparison with paratype material shows, and having been preserved in alcohol are badly shrivelled in consequence.<sup>8</sup>

***Orphulella elegans* Giglio-Tos.**

1894. [*Orphulella*] *elegans* Giglio-Tos, Bollett. Mus. Zool. Anat. Comp. Torino, IX, No. 184, p. 12. [Resistencia nel Chaco, Argentina; Province of San Pedro, Villa Rica and Asuncion, Paraguay.]

<sup>6</sup> Bollett. Mus. Zool. Anat. Comp. Torino, XII, No. 302, p. 24, 1897.

<sup>7</sup> Bollett. Mus. Zool. Anat. Comp. Torino, XIII, No. 311, p. 39, 1898.

<sup>8</sup> Bolivar's *Orphula patruelis* (*Actas Soc. Españ. Hist. Nat.*, XXV, p. 15) from the Rio Atalapo I have not recognized, and can give no idea of its proper position.

Four specimens, two of each sex, from Carcaraña, Argentina, determined as this species by Bruner, I am unable to separate from my series of *punctata*, which includes material determined as that species by Bruner. Individuals of the latter from Nicaragua, Costa Rica and British Guiana resemble the Carcaraña specimens very closely.

***Orphulella intricata* (Stål).**

1873. *T[ruxalis] intricata* Stål, Recensio Orthopterorum, I, p. 106. [Buenos Ayres.]

Two specimens, ♂ and ♀, one from Cordoba, the other from Carcaraña, Argentina, determined as this species by Bruner, are available for study. I am of the opinion that this species will prove to be merely a phase of the very variable *O. punctata*.

***Orphulella mexicana* (Saussure).**

1861. *Oxycoryphus] mexicanus* Saussure, Revue et Magasin de Zoologie, 2e sér., XIII, p. 314. [Mexico.]

Jalapa, Vera Cruz, Mexico. August. 2 ♀ ♀. (O. W. Barrett, A. N. S. P.) Coatepec, Mexico. August. 1 ♀. (Barrett, A. N. S. P.) Texolo, Mexico. March 13, 1899. 5 ♂ ♂. (S. N. Rhoads, A. N. S. P.)

The above records, with the Jalapa record given by Bruner in the *Biologia*,<sup>9</sup> constitute the sum of our knowledge of this species. It appears to be restricted in its range, as suggested by Bruner, and the taking of five specimens in one day shows it can hardly be called rare. The species is apparently confined to the country on the lower eastern slope of the Cofre de Perote. The compressed form of this insect will readily separate it from allied species. The compression of the male abdomen with its appendages is quite pronounced.

***Orphulella tepaneca* (Saussure).**

1861. *Stenobothrus] tepanecus* Saussure, Revue et Magasin de Zoologie, 2e sér., XIII, p. 319. [Mexico.]

Orizaba, Vera Cruz, Mexico. July 14, 1891. 1 ♂, 1 ♀. (W. S. Blatchley, A. N. S. P.)

This pair was received from Blatchley labelled "*Orphulella zapoteca*," but they are clearly not that species and answer Saussure's description of *tepanecus* very well. This species would appear to be limited in range to the vicinity of Orizaba, Bruner having also recorded it from there.

***Orphulella meridionalis* Bruner.**

San Marcos, Nicaragua. 1 ♂. (C. F. Baker, A. N. S. P.) Chinandega, Nicaragua. 1 ♂. (C. F. Baker, A. N. S. P.)

<sup>9</sup> *Biol. Cent.-Amer.*, Orth., II, p. 80, 1904.

These specimens have been compared with the Costa Rican individuals previously recorded by the author.<sup>10</sup>

***Orphulella zapoteca* (Saussure).**

1861. *Oxycoryphus* *zapoteca* Saussure, Revue et Magasin de Zoologie, 2e sér., XIII, p. 316. [Mexico.]

Texelo, Vera Cruz, Mexico. March 3 and 13, 1899. 8 ♂♂. (S. N. Rhoads, A. N. S. P.)

The specimens from Alta Mira, Tamaulipas, previously recorded by the author as *O. tepaneca* are referable to this species. The frontal costa, however, is moderately sulcate in all the Tamaulipas individuals.

***Orphulella viridescens* Scudder.**

1899. *Orphulella viridescens* Scudder, Canad. Entom., XXXI, p. 187. [Mt. Alvarez, Mexico.]

The specimens previously recorded by the author from Eslava, D. F., Mexico,<sup>11</sup> are now before me. This species is quite distinct from any other mainland form, and rather closely related to *O. scudderi*.

**DICHROMORPHA Morse.**

1896. *Dichromorpha* Morse, Psyche, VII, pp. 326, 383.

Type.—*Chloealtis viridis* Scudder.

***Dichromorpha mexicana* Bruner.**

1904. *Dichromorpha viridis* Rehn (not of Scudder), Proc. Acad. Nat. Sci. Phila., 1904, p. 518. [Guadalajara, Jalisco, Mexico.]

1904. *Dichromorpha mexicana* Bruner, Biol. Cent.-Amer., Orth., II, p. 87. [Sinaloa and Tepic, Mexico.]

Aside from the longer tegmina and wings this species differs from *viridis* in the slightly more robust form and the more acute fastigium in both sexes.

The range of this species now covers three States or Territories on the west coast of Mexico—Sinaloa, Tepic and Jalisco.

***Dichromorpha longipennis* Bruner.**

1904. *Dichromorpha longipennis* Bruner, Biol. Cent.-Amer., Orth., II, p. 87. [Mexico.]

Guadalajara, Jalisco, Mexico. August 20. 1 ♂. (J. F. McClendon, A. N. S. P.)

This specimen is uniform brown and does not exhibit the green dorsum mentioned by Bruner as present in the type ♂. This the first definite record of the species.

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<sup>10</sup> Proc. Acad. Nat. Sci. Phila., 1905, p. 802.

<sup>11</sup> Trans. Amer. Entom. Soc., XXVII, p. 95, 1900

**COCYTOTETTIX**<sup>12</sup> n. n.

1900. *Fenestra* Bruner (not of Giglio-Tos), Acc. Gen. Spec. Locusts Argent., pp. 22, 30.<sup>13</sup>

Included *F. pulchripennis*, *intermedia* and *argentina* Bruner, of which the first may be considered the type.

This genus is quite distinct from any other, but is nearer to the North American *Chloealtis* than any South American type. The Matto Grosso *C. linearis*<sup>14</sup> is rather aberrant in the slender form, narrow tegmina, weaker carina and more hyaline wings.

**Cocytotettix pulchripennis** (Bruner).

1900. *F[enestra] pulchripennis* Bruner, Acc. Gen. Spec. Locusts Argent., p. 30. [Argentina; open camp.]

Carcaraña, Santa Fé, Argentina. 2 ♂♂. (Through L. Bruner, A. N. S. P.)

**Cocytotettix intermedius** (Bruner).

1900. *F[enestra] intermedia* Bruner, Acc. Gen. Spec. Locusts Argent., p. 31. [Carcaraña, Argentina.]

Carcaraña, Santa Fé, Argentina. 2 ♂♂, 1 ♀. (Through L. Bruner, A. N. S. P.)

The ♂ of this species superficially remind one of the males of the certain species of the genus *Syrbula*.

**TOXOPTERUS** Bolívar.

1890. *Toxopterus* Bolívar, Anales Soc. Españ. Hist. Nat., XIX, p. 313.

Type.—*T. miniatus* Bolívar.

This genus is rather aberrant and isolated in position in consequence, but its position is in the Orphulellæ, and nearer to *Cocytotettix* than any other genus. The structure of the antennæ is similar to that of *Gomphocerus*, but such resemblance is also found in *Eritettix*, which is a member of the Amblytropidiæ, and are superficial and not of great taxonomic value.

**Toxopterus miniatus** Bolívar.

1890. *Toxopterus miniatus* Bolívar, Anales Soc. Españ. Hist. Nat., XIX, p. 314. [Cumbase, Peru.]

Sapucay, Paraguay. January 18, 1903. January 28, February 6–25, March 2–10, 1905. 7 ♂♂, 13 ♀♀. (Foster, Hebard Coll.)

<sup>12</sup> The genus *Fenestra* is invalid from Bruner (*Ann. Mus. Civ. Stor. Nat. Genova*, XXXIII, p. 120, 1893), as he designates no named species for type or included forms. The first species named under the generic term *Fenestra* was *F. bohlii* Giglio-Tos (*Zool. Jahrb., Syst.*, VIII, p. 807, 1895), which, on a subsequent page (p. 32), I will show to be the species later named *Dichroattettix viridifrons* Bruner, and for which the generic name *Fenestra* must be used.

<sup>13</sup> Κωκυτός, shrieking, tette, grasshopper; in allusion to the loud stridulations.

<sup>14</sup> *Proc. U. S. Nat. Mus.*, XXX, p. 374.

This series exhibits considerable variation in the intensity of the coloration, the dorsal aspect ranging in color from dull blackish brown to mottled ochre and umber and again washed with dull green. The paler lateral bands, including the ventral portion of the lateral lobes, pleura and caudal femora are distinct in all the specimens examined and in several are decidedly greenish; in these cases the genæ are also colored. Some individuals are distinctly maculate, or might really be called tessellate, ochre and umber being the two colors. Considerable variation in the sharpness of the angle of the fastigium is also noticeable, and in both sexes. In some females the angle is almost as acute as in some males.

The species has previously been recorded by Giglio-Tos<sup>15</sup> from Gualaquiza, Cuchipamba and the valley of Santiago, Ecuador.

#### GOMPHOCERI.

The South American genera of this group are six in number, three previously known and three recognized as the result of the present study. Of these genera two will be described in a subsequent paper, but they are mentioned here to show their position in the series. The genera would stand as follows:

*Fenestra* Giglio-Tos (= *Dichroattettix* Bruner).

*Staurorhectus* Giglio-Tos.

*Isonyx* n. gen.

*Borellia* n. gen.

*Stereotettix* n. gen.

*Tristira* Bruner.

The first genus is quite distinct, as is the second. The next three genera, *Isonyx*, *Borellia* and *Stereotettix*, show some characters in common, but differ in a number of others, such as the position of the lateral foveolæ and the relative proportion of the spurs. The last, *Tristira*, is a quite distinct type, much isolated from the others and immediately recognizable by its peculiar facies.

#### FENESTRA Giglio-Tos.

1895. *Fenestra* Giglio-Tos, *Zoolog. Jahrbücher, Syst. Abth.*, VIII, p. 807.

Type.—*F. bohlsii* Giglio-Tos.

1900. *Dichroattettix* Bruner, *Acc. Genera Spec. Locusts Argent.*, pp. 22, 32.

As I have stated on a previous page (p. 30) these names apply to the same genus and species. As there stated *Fenestra* is invalid from Bruner, 1893,<sup>16</sup> on account of the lack of a type or included named

<sup>15</sup> *Bollett. Mus. Zool. Anat. Comp. Torino*, XIII, No. 311, p. 39.

<sup>16</sup> *Ann. Mus. Civ. Stor. Nat. Genova*, XXXIII, p. 120.



by this series, is subject to little variation. Some of the females show considerable variation in the angle of the fastigium.

**STAUROREHECTUS** Giglio-Tos.<sup>18</sup>

1897. *Staurorhectus* Giglio-Tos, Bollett. Mus. Zool. Anat. Comp. Torino, XII, No. 302, p. 25.

*Type*.—*S. longicornis* Giglio-Tos.

This genus is apparently closer related to *Chorthippus* (*Stenobothrus*) than to any other genus of the group, the tegmina of the male being rather similar in some species, but the lateral foveolæ are very weak, the lateral carinæ of the pronotum are much less distinct and the caudal femora slenderer.

*Staurorhectus longicornis* Giglio-Tos.

1897. *S[taurorhectus] longicornis* Giglio-Tos, Bollett. Mus. Zool. Anat. Comp. Torino, XII, No. 302, p. 26. [San Lorenzo and Tala, Argentina; Caiza, Bolivia.]

Campo Santo, Bolivia.<sup>19</sup> 1 ♂. (Borelli, A. N. S. P.) San Lorenzo, Jujuy, Argentina. 1 ♀. (Borelli, A. N. S. P.) Sapucay, Paraguay. March 2-27, 1905. 12 ♂♂, 37 ♀♀. (Foster, Hebard Coll.)

The interesting series listed above exhibits a very great range of variation with four distinct color forms in the ♀; the ♂ is more uniformly colored. These forms I will designate *a*, *b*, *c* and *d*, lettering from the most diversified to the most uniform type.

*Type a*. A median longitudinal line from fastigium to tip of tegmina buff, flanked by lines of blackish brown on pronotum and tegmina, on the latter occupying all except a narrow proximal costal line of pale yellow. Lateral carinæ distinct, light, slightly constricted. Light bar on head slightly margined with brownish. Remainder of lateral aspect, and caudal femora except the dorsal blackish line and the reddish distal section, grass green. Represented by twelve specimens.

*Type b*. Similar to type *a*, but green replaced by ochraceous brown. Represented by eight specimens.

*Type c*. The dorsal median line in this type is almost lost and nearly concolorous with the lateral bars, so that dorsum from the fastigium caudad is nearly uniform. Represented by six specimens.

<sup>18</sup> It is quite possible this may prove to be the same as *Compsacris* Bolivar (*Anales Soc. Españ. Hist. Nat.*, XIX, p. 314, 1890) based on one species—*C. pulcher*—from "Villa Bella en el Perú," which is apparently Villa Bella, Bolivia, at the junction of the Beni and Mamore rivers. If such should prove to be the case *Compsacris* would replace *Staurorhectus*. None of the species examined by the author are closely related to *C. pulcher* judging from the description.

<sup>19</sup> Labelled as above, but Campo Santo, Salta Province, Argentina, is probably intended.

Type *d*. Tegmina colored much as in type *a*, but head, pronotum, pleura and limbs suffused with rose red, the usual markings being only faintly indicated. Represented by eleven specimens.

The largest ♀ specimen (38 millimeters in length of body) belongs to type *c*, the smallest (30 millimeters) to type *a*. The typical ♀ received from the Turin Museum has been immersed in a liquid preservative and it is impossible to tell to which type it belongs.

One ♂ individual has a coloration which would be considered type *c*, while the other males are of a type which approximates closer to the ♀ type *b* with, however, some greenish, but not on the caudal femora.

The curve of the fastigium of the female varies from arcuate to distinctly angulate, and is more excavated in some than in others.

***Staurorhactus glaucipes* n. sp.**

Type: ♀: Sapucay, Paraguay. March 8, 1905. (Foster; No. 32.) Hebard Collection.

Allied to *S. longicornis* Giglio-Tos, but considerably smaller and slenderer with the fastigium more acute, the frontal costa more sulcate, the lateral foveole of the vertex practically suppressed, the ulnar



Fig. 9.—*Staurorhactus glaucipes* n. sp. Lateral view of type. ( $\times 2$ .)

area of the tegmina without a distinct longitudinal dividing vein, no distinct continuous intercalary vein present, and possessing a characteristic coloration which does not appear to vary appreciably in a series of ten females.

Size rather small; form moderately slender. Head distinctly shorter than the pronotum, the occiput not elevated and gently arched longitudinally; fastigium shorter than the width at the cephalic angle of the eyes, slightly acute, the apex rounded, margins with a narrow semicircular depression, no median carina present; lateral foveole not distinct, ventrad; face considerably retreating, the apex acute when viewed laterad; frontal costa moderately wide, margins subparallel, reaching to the clypeus, sulcate from dorsal of the antennae ventrad; eyes elongate-oval, very slightly longer than the intraocular sulcus; antennae considerably exceeding the head and pronotum together in



length, nearly two-thirds the length of the tegmen, moderately depressed proximad and very slightly dilated. Pronotum moderately rounded but with a perceptible dorsal flattening; cephalic margin slightly arcuate, caudal margin broadly obtuse-angulate with the angle rounded, no lateral carinae present, but a moderate shoulder developed on the metazona; greatest caudal width contained about one and two-thirds in the length, metazona regularly and closely, but not deeply, punctate; three distinct transverse sulci present on the dorsum, the caudal only intersecting the median carina, which is distinct and regular; lateral lobes with the dorsal length very considerably greater than the depth, ventral margin sinuato-angulate. Interspace between the mesosternal lobes slightly longitudinal; interspace between the metasternal lobes hardly narrower than between the mesosternal lobes, pentagonal. Tegmina very slightly exceeding the apex of the abdomen, but falling considerably short of the caudal femora; marginal field with a very slight proximal dilation, apex rather narrowly rounded, no intercalary vein present. Wings ample. Abdomen considerably compressed. Caudal femora considerably inflated proximad, the distal section quite slender, pattern of the pagina very distinct, regular; caudal tibiae very slightly shorter than the femora, gently sinuate, the external margins with eleven or twelve spines, internal spurs slightly unequal; tarsi with distinct, rounded arolia.

General color apple green, becoming more oil green on the caudal femora. Two broad lines, one on each side, of vandyke brown start from the margins of the fastigium, cross the dorsum of the eyes, extend over the pronotum, and on the tegmina broaden out and occupy the entire discoidal and all except the proximal portion of the marginal fields. On the head the color of these bars is decidedly blackish brown, about true vandyke brown on the pronotum, becoming dilute and fainter as the stripe broadens on the tegmina, while along the ventral margins of these bars the green is touched with yellowish, while the light proximal section of the marginal field is cream color. Antennae vandyke brown with the proximal joint green; eyes tawny-olive and bistre mottled; caudal femora with the genicular regions laterad and ventrad black, the pagina with a dorsal longitudinal bar of



Fig. 10. — *Staurorhectus glaucipes* n. sp. Dorsal view of head and pronotum of type. ( $\times 3$ .)

olive, except for a pregenicular annulus of clear green; caudal tibiae bice green, the genicular section blackish and the distal portion slightly suffused with brownish, spines and spurs tipped with black.

*Measurements.*

Length of body, . . . . .	26 mm.
Length of pronotum, . . . . .	5 "
Length of tegmen, . . . . .	19 "
Length of caudal femur, . . . . .	16.3 "

A paratypic series of nine males have also been examined, the dates being as follows: December 21, 1904; January 26, February 15, March 7, 18 and 21, 1905. This series is rather uniform in size, two females, however, being appreciably smaller than the others. In color one specimen has the green more glaucous, while several others show a tendency in the same direction. One specimen has the caudal femora, the lateral lobes and the face suffused with orange vermillion. The intensity of the longitudinal bars appears to vary very little; on the tegmina, however, some specimens are more strongly colored than others.

**ISONYX** n. gen.<sup>20</sup>

This genus probably is closer related to *Borellia* Rehn<sup>21</sup> than to *Staurorhectus*, and may possibly be considered a distinct and separate type with no close relationship to either the above mentioned genera. The characters are so contradictory and the facies so different that the author does not feel justified in making detailed comparisons, but prefers to present the rather striking features of the form in the general description. It might be added that this position is assigned to *Isonyx* after studying all the South American Gomphoceri, both genera and species.

***Isonyx paraguayensis*** n. sp.

Types: ♂ and ♀. Sapucay, Paraguay. February 12 (♀) and 27 (♂), 1905. (Foster; Nos. 24 and 165.) Hebard Collection.

Size rather small; form moderately compressed and slender; surface subsericeous. Head slightly (♂) or considerably (♀) shorter than the pronotum, the occiput very slightly elevated and rounded; fastigium subrectangulate in the male, obtuse-angulate in the female, very much shorter than the width at the cephalic angle of the eyes, margins

<sup>20</sup> *Isoos*, equal; *onyx*, claw.

<sup>21</sup> *Proceedings of the U. S. National Museum*, XXX p. 379.

distinct with a broad sublunate intermarginal depression, no median carina present, fastigium when viewed laterad moderately declivent;



Fig. 11.—*Isonyx paraguayensis* n. gen. and sp. Lateral view of female type. ( $\times 3$ .)

dorsal section of the face vertical, ventrad of the antennæ considerably ( $\sigma$ ) or gently ( $\phi$ ) retreating; lateral foveolæ distinct, cephalic well impressed and excavated, sublanceolate; frontal costa strongly compressed dorsad, regularly expanding ventrad of the antennæ to the clypeus, with an additional rotundate expansion at the ocellus, slightly sulcate ventrad of the ocellus; eyes subovate in the male, subovoid in the female, flattened cephalad in the latter sex, moderately prominent



Fig. 12.—*Isonyx paraguayensis* n. gen. and sp. Dorsal view of head and pronotum of female type. ( $\times 3$ .)



Fig. 13.—*Isonyx paraguayensis* n. gen. and sp. Lateral view of abdomen of male type. ( $\times 6$ .)

in the male when viewed dorsad; antennæ subequal to the head and pronotum in length in the male, slightly shorter in the female. Pronotum deplanate dorsad, the greatest caudal width contained about once and a quarter in the length; cephalic margin subtruncate, caudal

margin obtuse-angulate in both sexes; median carina distinct but not high, severed by the third sulcus slightly cephalad of the middle; lateral carinae clepsydral, strongly constricted to the first sulcus, absent between the first and second, straight between the second and third, wider spaced caudad of the third sulcus than cephalad of it, arcuate diverging caudad; lateral lobes with the greatest dorsal length slightly less than the greatest depth, the ventral margin sinuato-angulate, a weak shoulder running diagonally ventro-cephalad on the prozona. Interspace between the mesosternal lobes subquadrate in the male, slightly transverse in the female; metasternal lobes contiguous caudad in the male, separated by a small ovate space in the female. Tegmina slightly exceeding the tips of the caudal femora, the tips rounded, costal margin with the proximal lobe small and low; intercalary vein present, distinct but irregular, and becoming lost proximad in the reticulations; ulnar area with a longitudinal dividing vein as distinct as the intercalary in the male, more distinct and regular in the female. Wings ample. Abdomen considerably compressed; cerci of the male styliform, apex rather blunt; subgenital plate of the male somewhat contracted and turned in dorsad, apex moderately acute and but slightly produced. Cephalic and median limbs rather slender, more robust and somewhat inflated in the male. Caudal femora quite robust, considerably inflated, pagina sharply but not very deeply sculptured; caudal tibiae slightly shorter than the femora and with a hardly perceptible sinuation, lateral margins with ten spines in the male and nine in the female, internal spurs moderately arcuate, equal; tarsi with distinct arolia.

General color vandyke brown, mottled and overlaid with seal brown, clove brown and blackish. Eyes cinnamon (♂) or mummy brown (♀); occiput with two dark arcuate, diverging bars extending caudad from between the eyes. Pronotum with the lateral carinae, lateral sections of the dorsum of the metazona and the extreme upper portions of the lateral lobes seal brown or blackish, leaving a unicolor median bar extending from the fastigium to the caudal margin of the pronotum, which is more or less hazel in the male and apple green in the female; remaining section of the lateral lobes mottled and lined. Tegmina with a longitudinal discoidal series of quadrate clove brown spots, the marginal field in the female touched proximad with apple green, and the sutural margin in the male with a touch of vinaceous-cinnamon. Limbs mottled and faintly annulate with the general colors, the caudal femora blackish in the genicular region and with the dorso-lateral face marked with several velvety seal brown spots,

one submesad and another nearer the base; caudal tibiae dull olive with a faint proximal lighter annulus, the spines and spurs tipped with black; tarsi soiled greenish with the proximal part of the first joint, the whole second and the tip of the third blackish.

*Measurements.*

	♂	♀
Length of body, . . . . .	17.7 mm.	21 mm.
Length of pronotum, . . . . .	3.2 "	4.3 "
Length of tegmen, . . . . .	14.5 "	18.3 "
Length of caudal femur, . . . . .	10.7 "	13 "

A paratypic series of six females has also been examined (February 13, 15 and 27, March 17 and 21, 1905). This series shows that the species varies somewhat but not greatly in size, and the coloration presents a considerable range of base tones and finer definition of markings without much modification of such pattern as is found in the types. Two specimens are touched with green as in the ♀ type, but both have it weaker on the head and tegmina, and the lateral carinae are broadly marked with the same tint on the metazona, and the caudal femora have distinct oblique blackish bars. Other specimens have the lighter general colors replaced by ferruginous or wood brown, giving a warm rufescent type or a rather sandy form, while the femoral bars are present as variations irrespectively of color form. All the females except the type have the lateral carinae marked with lighter on the metazona. One of the rufescent type has the dark colors all blackish, presenting a strong contrast with the other ferruginous patches.

**SCYLLINÆ.**

After examining individuals of all the genera of the *Scyllinae* except *Eupnigodes* McNeill and *Zapata* Bruner, the following arrangement of the genera seems to be desirable as it appears to express their natural relations:

- Boöpedon* Thomas.
- Euplectrotettix* Bruner.
- Scyllina* Stål.
- Eupnigodes* McNeill.
- Zapata* Bruner.
- Psoloessa* Scudder.
- Stirapleura* Scudder.
- Ageneotettix* McNeill.
- Aulocara* Scudder.
- Ligurotettix* McNeill.

The position of *Eupnigodes* and *Zapata* is taken from other authors, while *Ligurotettix* is placed here instead of in the *Epacromiæ*, as it is quite different from *Mecostethus* and *Epacromia*, approaching *Aulocara* in some respects. While no doubt somewhat aberrant *Ligurotettix* is clearly a member of the Scyllinæ, the intercalary vein, for example, being no stronger than is the case in many specimens of *Aulocara*.

#### EUPLECTROTETTIX Bruner.

1900. *Euplectrotettix* Bruner, Acc. Gen. Spec. Locusts Argent., pp. 23, 38 (*Euplectrotettix* laps. p. 38).

Included *E. ferrugineus*, *conspersus*, *schulzi* and *prasinus* Bruner, of which *ferrugineus* may be considered the type.

#### *Euplectrotettix ferrugineus* Bruner.

1900. *Euplectrotettix ferrugineus* Bruner, Acc. Gen. Spec. Locusts Argent., p. 39. [Sandy knolls about Asuncion, Paraguay; Territory of Formosa, Argentina.]

Sapucay, Paraguay. February 13, 1903; December 16, 1904; January 26, February 10-25, March 2-19, 1905. 9 ♂♂, 10 ♀♀. (Foster, Hebard Coll.)

These specimens are all larger than the measurements given by Bruner, but otherwise do not appear to materially differ. The series is quite uniform in size, and an average ♂ and ♀ measure as follows:

	♂	♀
Length of body, . . . . .	18.5 mm.	25 mm.
Length of pronotum, . . . . .	3.5 "	4.8 "
Length of tegmen, . . . . .	15.5 "	21 "
Length of caudal femur, . . . . .	11.5 "	15.2 "

Two distinct types of coloration are present, one irregularly mottled and washed with fuscous, the other with a light orange ochraceous median bar on the head and pronotum, flanked by blackish lateral lines, which are filiform on the head and broader on the pronotum. The tegmina in the latter type also possess a pair of light parallel longitudinal lines on the anal areas.

The indications of femoral bars mentioned by Bruner are quite strong in nearly all the females and several of the males examined, while the blackish genicular region of the ♂ and the orange-red abdomen of the same sex are quite striking.

#### SCYLLINA Stål.

187. *Scyllina* Stål, Recensio Orthopterorum, I, p. 112.

Included *S. peragrans* (Stål) and *S. viatoria* (Saussure) of which

the former is the type, the latter having been removed to *Plectrophorus* (= *Plectrotettix*) by McNeill.

1895. *Pseudostauronotus* Giglio-Tos, Zool. Jahrb., Abth. Syst., VIII, p.

808. Type.—*P. brunneri* Giglio-Tos.

1897. *Plectrophorus* McNeill, Proc. Davenp. Acad. Nat. Sci., VI, p. 198, 251, pl. 4, fig. 21 [not of Férussac, 1819]. Included *Stenobothrus viatorius* and *gregarius* Saussure.

1897. *Plectrotettix* McNeill, Psyche, VIII, p. 71.

Of the various species here considered a series of one hundred and fifty-six specimens have been examined, including typical material of the five species described by Bruner. Thorough consideration of this material shows that no tangible characters exist for separating *Scyllina*, *Pseudostauronotus* and *Plectrotettix* even as subgenera as proposed by Bruner.<sup>22</sup> The characters on which the subdivisions were there made are: the presence or absence of an intercalary vein in the post-radial area, the cells of this region being accordingly arranged in two series or else irregularly reticulate; the caudal lobe of the pronotum either subequal to or longer than the cephalic; the inner claw of the hind tibiæ more or not more than twice the length of the outer, and the number of spines on the outer margin of the hind tibiæ (9 to 12 or 13 to 16).

The first of these characters can usually be depended upon as stable, but in this genus the intercalary vein is by no means a stable character being present or absent in individuals of the same species, and in some cases varying in an individual to the extent that it is distinct on one tegmen and absent on the other. The proportions of the lobes of the pronotum are also found to vary, as in species belonging unquestionably to the section supposed to have subequal divisions the caudal section distinctly exceeds the cephalic in length, while the reverse is the case in other species. The length and shape of the tibial claws while diagnostic when the type species alone are compared, is without value when other forms are considered; specimens of *varipes*, which is allied to *conspersa*, has the spurs no longer than is found in Mexican forms referred to *Plectrotettix*. The number of tibial spines is a character which appears unworthy of use in separating subgenera, especially when the extent of variation is such as to cause great doubt as to which division a particular specimen belongs.

While the type of the genus *Gomphocerus* (*Epacromia*) *peragrans* Stål,<sup>23</sup> has not been recognized since the original description, a circumstance probably due to the fact that the type locality is an unfre-

<sup>22</sup> Biol. Cent. Amer., Orth., II, pp. 99-100.

<sup>23</sup> Kongliga Svenska Fregatten *Eugenies* Resa, Zool., I, p. 343, 1860. [Puna.]

quoted one, the description is such that it could be identified with little difficulty.

The name *Pseudostauronotus* was proposed by Giglio-Tos under the impression that the type, *brunneri*, was a member of the very insufficiently described genus to which Brunner applied the same name two years previously.<sup>24</sup> As Brunner's name rests on a description of seven words without included species or type mentioned, it is really a *nomen nudum* and as such not invalidating the later use of the name by Giglio-Tos, even when used in misapprehension. Scudder has shown<sup>25</sup> from the evidence of material sent him by Brunner that *Pseudostauronotus* of that author equals his much older *Stirapleura*.

Some species of the genus appear to resemble species of *Boöpedon*, others forms of *Stirapleura* and several have a striking superficial resemblance to forms of the Locustine genus *Schistocerca*. The following arrangement appears to present their relationship as clearly as possible in a linear arrangement.

Species but little variegated, the coloration rather uniform; lateral carinæ of the pronotum moderately arcuate, not prominent; superficially resembling *Boöpedon*.

*Seyllina uniformis* Rehn.

*Seyllina instabilis* n. sp.

Types: ♂ and ♀; São Paulo, São Paulo, Brazil. September 5, 1900. (Adolph Hempel; No. 202.) A. N. S. Phila.

This species is closely allied to *S. uniformis*, but differs in the sharper caudal angle of the pronotum, the longer metazona of the pronotum (much longer than the prozona), the slightly narrower interspace between the eyes and the rather different type of coloration.

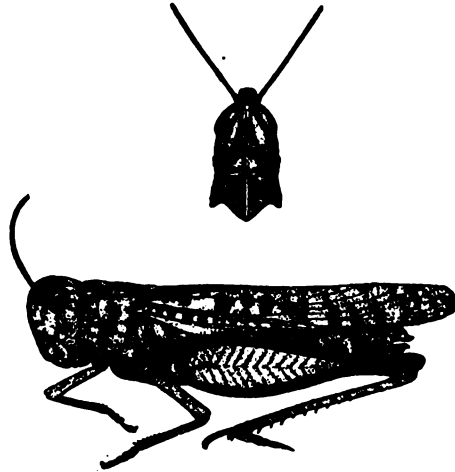
Size medium; form robust. Head with the fastigium broad, rounded rectangulate, depressed area crescentic, interspace between the eyes equal to the interantennal width of the frontal costa, lateral foveolæ oblong, punctate, slightly impressed; viewed laterad the fastigium rounds into the frontal costa without angle; frontal costa broad, subequal, slightly constricted above the antennæ, two rows of punctures dorsad; supplementary facial carinæ indistinct ventrad; eyes acute reniform, slightly longer than the infraocular portion of the genæ; antennæ slender, slightly depressed proximad. Pronotum with the cephalic margin arcuato-truncate, caudal margin obtuse-angulate, sharper in the male than in the female; median carina rather high, distinct, cut slightly cephalad of the middle by the

<sup>24</sup> Ann. Mus. Civ. Stor. Nat. Genova, XXXIII, p. 123, 1893.

<sup>25</sup> Canad. Entom., XXIX, p. 76, 1897.



distinct transverse sulcus; lateral carinæ distinct cephalad and caudad, subobsolete mesad with the constriction slight; lateral lobes slightly over half as deep again as long, cephalic and caudal margins subparallel, ventral margin rounded obtuse-angulate. Tegmina distinctly ( $\sigma^7$ ) or moderately exceeding the apex of the abdomen, but only slightly exceeding the tips of the caudal femora; costal expansion slight, low, apex rotundato-truncate; postradial area irregularly areolate. Cephalic and median limbs rather slender. Caudal femora robust, inflated, the distal portion slenderer and with the pregenicular portion constricted, carinæ strongly ribbed, pattern of the pagina distinct and regular; caudal tibiæ with eleven spines laterad, longer internal spur slightly more than twice the length of the shorter, sharply curved distad but not distinctly hooked.



Figs. 14 and 15.—*Scyllina instabilis* n. sp. Female type. Dorsal view of head and pronotum and lateral view. ( $\times 1\frac{1}{2}$ .)

General color ranging from ochraceous-rufous (male) to dull hazel and clay color (female). Head with a blackish postocular bar distinct in the male, slight in the female; infraocular line very distinct in the male, absent in the female; lateral margins of the frontal costa and ventral portion of the lateral foveolæ lined with blackish, more distinct in the male than in the female; face and sides of the head blotched with a darker brown in the female; eyes rather cinnamon in the male, pale isabella color in the female; antennæ of the general color. Pronotum of the male clear ochraceous-rufous, with the lateral carinæ slightly marked cephalad, the lateral lobes with a broad

blackish bar extending from the principal transverse sulcus dorsad obliquely ventrad to the ventro-cephalic angle; of the female with a dorsal cross imperfectly indicated by dull hazel on a clove brown ground, lateral lobes reddish clay color with weak longitudinal blotches of broccoli brown. Tegmina with the anal area obsolete maculations in both sexes, those of the female more distinct than those of the male, remainder with rather narrow rather regularly disposed transverse bars of clove brown, which are weaker distad than proximad in the female, but uniform in strength in the male. Limbs cream buff marked with clove brown; caudal femora cream ochraceous-rufous dorsad in the male, not barred, in the female hazel with four rather weak transverse bars of dull brown, carinae of the lateral face dotted with blackish, the pattern of the pagina outline in brownish; ventral face very dark verditer blue; caudal tibiae ranging from orange-vermilion (male) or chinese orange (female) proximad to maroon purple (male) or burnt carmine (female), spine blackish at the tips.

*Measurements.*

	♂	♀
Length of body, . . . . .	24.5 mm.	33 mm.
Length of pronotum, . . . . .	5.4 "	6.2 "
Length of tegmen, . . . . .	23 "	28.5 "
Length of caudal femur, . . . . .	18.3 "	21.3 "

In addition to the types a paratype series of five males (September 5 and 14, 1900) have been examined. Considerable color variation is presented by this series, which is roughly divisible into three types: one (a) with the dorsum of the pronotum unicolorous, which is represented by the type alone, another (b) with a rather pale median pronotal line flanked laterad by blackish, represented by three individuals, and a third (c) with a pronotal cross as in the ♀ with the caudal margin of the pronotum as pale as the cross, represented by two specimens. The median pale line is distinctly carried to the tips of the tegmina in one of type b, while the transverse tegminal bars are rather regular and distinct, though not complete in some specimens; a pale proximal tegminal line is present in two individuals of type b. The dorsum of the caudal femora is distinctly barred in both of type c, and faintly in one of type b, while the lateral face shows distinct oblique bars in several specimens. The color of the caudal tibiae in all males other than the type is as in the ♀ type. A single ♂ specimen from Sapucay, Paraguay (III 9.05; Foster, No. 195 part), in the Hebard Collection, is referred to this species. It presents a rather different appearance

when compared with the typical series, but the differences are wholly of color. The dorsum of the pronotum is to a large extent velvety black, broken at the sulci, while the lateral carinæ are marked as in specimens of type *c*, but darker, with the median longitudinal bar present.

***Seyllina picta* (Bruner).**

1900. *P[lectrotettix] pictus* Bruner, Acc. Genera Spec. Locusts Argent., p. 37, fig. 13. [Cordoba and Sante Fé Provinces, Carcaraña and Rosario, Argentina.]

A topotypic series of three males and three females from Carcaraña, collected by Bruner, have been examined.

This species is only known from Cordoba and Sante Fé Provinces, Argentina.

***Seyllina brunneri* (Giglio-Tos).**

Sapucay, Paraguay. February 13, 1905. 1 ♂. (Foster, Hebard Coll.)

This specimen is considerably darker than any strongly marked specimen of this species seen. The whole insect is quite dark except for the light femoral bars, but the pattern is still distinctly visible, the medio-dorsal and lateral bars being present, and the tegminal streak clear apple green. The size of this specimen is slightly greater than Matto Grosso specimens.

***Seyllina pratensis* (Bruner).**

1904. [*Plectrotettix*] *pratensis* Bruner, Biol. Cent.-Amer., Orth., II, p. 100. [Pernambuco, Brazil.]

Paratypic specimens, a ♂ and ♀, of this species, loaned by Prof. Bruner, have been examined. They differ from *brasiliensis* in the slightly smaller size, rather slenderer form, less divergent carinæ of the pronotum and the more acute fastigium. The color of the caudal tibiæ is of little diagnostic value, as in other species of the genus, the male in hand having them wholly red, the female ochraceous with the dorsal surface purplish distad and reddish proximad.

*Measurements of paratypes.*

	♂	♀
Length of body, . . . . .	20.2 mm.	26.5 mm.
Length of pronotum, . . . . .	4 "	5 "
Length of tegmen, . . . . .	18.5 "	23.5 "
Length of caudal femur, . . . . .	15 "	17.5 "

***Seyllina gregaria* (Saussure).**

1861. *S[tenobothrus] gregarius* Saussure, Revue et Magasin de Zoologie, 2e sér., XIII, p. 318. [St. Thomas; Haiti.]

1903. *Plectrotettix gregarius* Rehn, Trans. Amer. Entom. Soc., XXIX, p.

133. [Utuaño, Arroyo, Bayamon and Mayaguez, Porto Rico; Culebra and Vieques Islands.]

A ♀ from Vieques Island has been examined in this connection. The species is closely related to *pratensis*, but differs in the narrower space between the eyes and the greater interantennal constriction of the frontal costa. It is interesting to note that the known ranges of these very closely related species are separated by a distance of over two thousand miles, in the land areas of which, as far as at present known, no species of the genus is found.

***Soyllina brasiliensis* (Bruner).**

1904. [*Plectrotettix*] *brasiliensis* Bruner, Biol. Cent.-Amer., Orth., II, p. 100. [Southern Brazil.]

Sapucay, Paraguay. 1 ♂, 1 ♀. Prof. Bruner's Coll. Sapucay, Paraguay. January 28, February 2-27, March 6-10, 1905. 11 ♂♂, 20 ♀♀. (Foster, Hebard Coll.) São Paulo, São Paulo, Brazil. September 1-14, 1900. 4 ♂♂, 6 ♀♀. (Hempel, A. N. S. P.)

The Sapucay specimens loaned by Prof. Bruner are marked as types, although the locality southern Brazil is given with the original brief description.

The variation in the intensity of the markings of this species is quite considerable. The males appear to be, for this genus, rather uniform in coloration, and the variation in size is not very great. The females, however, vary greatly in the amount and shade of green coloring, some having the dorsal face of the caudal femora, head and the greater portion of the pronotum and pleura rather pale apple green, while others have these parts mottled and overlaid more or less strongly with dull brown. In a few specimens the green, except the tegminal bar, is wholly replaced with a shade of brown, but in such cases the pattern remains the same. In the material examined but very few specimens have the characteristic pattern obscured and even in those cases it is not obliterated.

As a series the females are quite uniform in size, one Sapucay female, however, being quite large. This latter individual is also very deeply colored.

The measurements of Bruner's Sapucay specimens and the large ♀ mentioned above are as follows:

	BRUNER. ♂	BRUNER. ♀	LARGE. ♀
Length of body, . . . . .	23.5 mm.	30.3 mm.	34.5 mm.
Length of pronotum, . . . . .	4.5 "	6 "	6.7 "
Length of tegmen, . . . . .	21 "	26.8 "	29.5 "
Length of caudal femur, . . . . .	15 "	20 "	22.3 "

The records of this species given above cover the known region, from São Paulo, Brazil, to western Paraguay.

***Seyllina conspersa* (Bruner).**

1904. [*Plectrotettix conspersus* Bruner, Biol. Cent.-Amer. Orth., II, p. 100  
[No locality.]

Sapucay, Paraguay. December 17, 1901; December 16, 1904. January 26 and 28, February 8-15, 1905. 9 ♂♂, 11 ♀♀. (Foster, Hebard Coll.)

Through the kindness of Prof. Bruner I have before me the type of this species, a ♀ from Sapucay, Paraguay. From the material in hand it appears that this species has several color forms, as in *brunnei* and other species. The type has the dorsal surface of the head and pronotum uniform wood brown without cruciform markings or longitudinal median stripe, and a majority of the females and several of the males examined belong to this type. Several males and females have the dorsum dark with weak, but distinct, cruciform pronotal markings and a longitudinal light bar of variable prominence, in some cases absent. In about half the specimens the heavy blackish markings on the lateral lobes of the pronotum and caudad and ventrad of the eyes are distinct, while the dorsal bars of the caudal femora are distinct in the greater number, weak and interrupted in several others including the type, dorso-lateral carina of the femora marked ventrad with blackish in all specimens, very distinct in some, broken and faint in others, the genicular lobes also blackish.

*Measurements of the type.*

Length of body, . . . . .	34.7 mm.
Length of pronotum, . . . . .	6.9 "
Length of tegmen, . . . . .	32.2 "
Length of caudal femur, . . . . .	22.5 "

***Seyllina suffusa* Rehn.**

***Seyllina varipes* (Bruner).**

1905. *Plectrotettix varipes* Bruner, Entom. News, XVI, p. 214. [Sapucay, Paraguay.]

Sapucay, Paraguay. March 5 and 15, 1905. 4 ♂♂, 5 ♀♀. (Foster, Hebard Coll.)

These specimens have been compared with typical individuals kindly loaned by Prof. Bruner. This species is very richly colored and one of the more easily recognized forms, the distinct femoral bars and the entirely black genicular region being quite striking in all the specimens examined. Considerable superficial resemblance exists to *S. conspersa*, which is found in the same locality, but the angle of the

face and the shorter and heavier caudal femora, as well as the color of the caudal tibiae, serve to separate it without difficulty. In the case of this species and *S. conspersa* the colors of the tibiae appear to be constant, all the specimens of *conspersa* examined having the distal section dark bluish, while the deep rich crimson of the distal two-thirds of *varipes* is clear and uniform in the whole series.

*Seyllina smithi* Rehn.

*Seyllina borellii* Giglio-Toa.

*Seyllina schistocerosides* Rehn.

*Seyllina viatoria* (Saussure).

Specimens recorded by the author as this species from Texolo, La Joya, San Luis Potosi and Alta Mira, Tamaulipas, when re-examined in the light of recent work on the Mexican and Central American forms of the genus, prove to represent true *riatoria*. The males have the dorsal face of the caudal femora distinctly barred, while the females have these parts almost uniform green.

*Seyllina calida* (Bruner).

1904. *Plectrotettix calidus* Bruner, Biol. Cent.-Amer., Orth., II, p. 101 [Cuernavaca, Morelos and Guerrero, Mexico, Nicaragua, Costa Rica.]

Previous records of the author of *riatoria* from Cuernavaca, Uruapan, Gualajara, Zapotlanejo and Zapotlan should be referred to this species.

The range of variation in size and coloration in this form is very great, some individuals having the colors weak and poorly defined, while other individuals from the same locality are quite richly colored. The width, number and intensity of the transverse bars of the tegmina also varies greatly as in some individuals they are as broad as the intervening sections, while in others they are broken, imperfect and rather pardaline in character and distribution.

*Seyllina excoelus* (Bruner).

1904. *Plectrotettix excoelus* Bruner, Biol. Cent.-Amer., Orth., II, pp. 101-102. [Tlalpam and Tacubaya, Mexico.]

A male and two females of this species from Tacubaya show that this is probably the most striking Mexican species. These individuals have been previously recorded by the author as *riatoria*. The rather short tegmina, more robust form and heavier caudal femora will assist in separating this from the allied species. These specimens show practically no green, the light shades being ochres.

#### **POOLOESSA** Scudder.

1873. *Pooloessa* Scudder, Proc. Boston Soc. Nat. Hist., XVII, p. 312

Included *P. texana*, *ferruginea* and *maculipennis* Scudder, of which *maculipennis* can be considered the type.

***Psoloessa maculipennis* Scudder.**

1875. *Psoloessa maculipennis* Scudder, Proc. Boston Soc. Nat. Hist., XVII, p. 513.

San Luis Potosi, Mexico. August 5, 1903. 1 ♀. (M. E. Hoag, A. N. S. P.)

This species has been recorded from Texas, New Mexico, Arizona and California.

***Psoloessa buddiana* Bruner.**

1889. *Psoloessa Buddiana* Bruner, Proc. U. S. Nat. Mus., XII, p. 61, t. I, fig. 6. [Carrizo Springs, Southwest Texas.]

Zapotlan, Jalisco, Mexico, July 7, 1902. ♂, ♀. (C. H. T. Townsend, A. N. S. P.)

These specimens are referred here with some little doubt. The species has been recorded from Montelovez, Coahuila.

**STIRAPLEURA Scudder.<sup>28</sup>**

1876. *Stirapleura* Scudder, Ann. Rep. Chief of U. S. Engineers, 1876, pt. 3, p. 510.

Type.—*Stirapleura decussata* Scudder.

Specimens of all the South American forms of this genus have been examined and the species are here listed to show their relationship.

***Stirapleura variabilis* Bruner.*****Stirapleura signatipennis* (Blanchard).**

1851. *Ædipoda signatipennis* Blanchard, in Gay, Hist. Fis. y Polit. de Chile, Zool., VI, p. 79. [Coquimbo, Chili.]

Penco, Chili. December, 1903. 7 ♀ ♀. (C. S. Reed, A. N. S. P.)  
Concepcion, Chili. 1 ♀. (C. S. Reed, A. N. S. P.)

These specimens fully agree with Blanchard's original description. This is the largest species of the genus, exceeding even the North American *S. decussata*. An average ♀ measures as follows:

Length of body, . . . . .	25 mm.
Length of pronotum, . . . . .	4.8 "
Length of tegmen, . . . . .	19 "
Length of caudal femur, . . . . .	16.5 "

***Stirapleura bruneri* n. n.**

1900. [*Stirapleura*] *signatipennis* Bruner (not *Ædipoda signatipennis* Blanchard), Gen. Sp. Locusts Argent., p. 34. [Argentina from the Pampa Central and extending into Uruguay to the eastward.]

This species is quite distinct from *signatipennis* Blanchard, as six

<sup>28</sup> Saussure's *Stenobothrus chilensis* (*Revue et Magasin de Zoologie*, 2e sér., XIII, p. 319, 1861) is no doubt a member of this genus, and possibly the male of *signatipennis*, the female being the only sex known to the author. The size given by him (length with elytra 15 mm.) is much too large for the male of *humilis*.

specimens from Carcaraña, Argentina, determined by Bruner show. The Argentine form is smaller, with the lateral carinæ of the pronotum more constricted and the coloration more variable than in *signatipennis*. This is apparently one of the species on which Bruner erected his insufficiently characterized *Pseudostauronotus*,<sup>27</sup> as specimens received from Saussure from Buenos Ayres bear the manuscript name *Pseudostauronotus occidentalis*.

***Stirapleura humilis* (Blanchard).**

1851. *Edipoda humilis* Blanchard, in Gay, Hist. Fis. y Polit. de Chile, Zool., VI, p. 79. [Coquimbo, Chili.]

Penco, Chili. November and December, 1903, and February, 1904. 17 ♂♂, 16 ♀♀, 5 immat. (C. S. Reed, A. N. S. P.) Concepcion, Chili. November and December, 1903, and February, 1904. 20 ♂♂, 7 ♀♀, 3 immat. (Reed, A. N. S. P.) Coronel, Chili. January, 1904. 1 ♂. (Reed, A. N. S. P.) Longuen, Chili. February, 1904. 2 ♂♂, 4 ♀♀. (Reed, A. N. S. P.) Gultio, Chili. December, 1903. 2 ♂♂, 6 ♀♀. (Reed, A. N. S. P.) Lota, Chili. October, 1903. 1 ♂. (Reed, A. N. S. P.)

This large series exhibits a very great amount of individual variation in size and color. The females range in total length from 13 to 20 millimeters, the males varying proportionately. The color ranges from a mottled black-brown and gray with femoral bars and weakly lateral carinæ of the pronotum, to another with the general color pale with broad dark lateral bars on the dorsum of the head and pronotum with a broad pale median bar, a longitudinal dark bar on the tegmina flanked toward the costa by a pale green line, and the femora with bars and suffused along the dorso-lateral carinæ with blackish. The latter type has the markings of the lateral lobes of the pronotum quite distinct and the genicular regions of the caudal femora and tibiæ are paler than in the other type, in which these portions are blackish. These differences are irrespective of locality and date, and are connected by dozens of intermediates.

This species appears to fit Blanchard's form, some specimens agreeing very well with the rather vague description. It is apparently a common species.

***Stirapleura pallida* Bruner.**

***Stirapleura obscura* Bruner.**

The position of this species is a little doubtful. In some respects it resembles *bruneri*, but its general characters approach *brunnea*.

***Stirapleura brunnea* Rehn.**

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<sup>27</sup> *Ann. Mus. Civ. Stor. Nat. Genova*, XXXIII, p. 123, 1893.



## MARCH 6.

The President, SAMUEL G. DIXON, M.D., in the Chair.

One hundred and twenty-seven persons present.

The death of William W. Jefferis, a member, February 24, 1906, was announced.

The reception of a paper entitled "Phylogeny of the Races of *Volutilithes petrosus*," by Burnett Smith, Ph.D. (February 23), was reported.

DR. WILLIAM P. WILSON made a communication on the Philippine Islands, their resources, their inhabitants and present progress toward independence. (No abstract.)

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MARCH 20.

MR. ARTHUR ERWIN BROWN, Vice-President, in the Chair.

Sixty-nine persons present.

Miss Mary S. Holmes made a communication on the Dos Pueblos Cañon, California. (No abstract.)

Francis William Rawle was elected a member.

The following were ordered to be printed:

PHYLOGENY OF THE RACES OF *VOLUTILITHES PETROSUS*.

BY BURNETT SMITH, PH.D.

## INTRODUCTION.

In a recent article <sup>1</sup> the author has described some of the shell characters which, occurring in the later stages of Gastropod ontogeny and phylogeny, mark the gerontic or senile condition of the individual or of the race. It was seen that these senile features may at times be as useful to the student of phylogeny as those of the earlier stages, which latter have always received the more attention. In the paper referred to, the attempt was made to show that the modern *Fulgur carica* of our New Jersey coast is the descendant of a main *F. carica* stock, which originated in Miocene time; and that such forms as *F. maximum* and its allies, which had heretofore been regarded as ancestral by Grabau <sup>2</sup> and others, are in reality not so at all, but senile offshoots which at an early period in the history of the stock diverged from the main line of descent. The paucity of individuals representing the forms considered ancestral, and the extreme abundance of the specimens of senile forms, was a source of some embarrassment to the author. It is therefore with considerable satisfaction that I am now able, though in another genus (*Volutilithes*), to present a series in which the forms comprising the main ancestral stock are nearly as plentiful as those which represent the senile offshoots.

The history of certain of the species of *Volutilithes* can be well traced in the Eocene of our Gulf States, but nowhere better than in Alabama, where the fine sections along the Alabama and Tombigbee rivers have furnished abundant material for the study of the geological and geographical distribution of these forms. The races and species studied range from the Matthew's Landing horizon in Alabama to the Jackson horizon in Mississippi, and therefore represent a fair proportion of the phylogenetic units through nearly the whole of the Eocene. They are likewise restricted to a small geographical area, and the geological sections in which they appear are unusually good.

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<sup>1</sup> Senility among Gastropods, *Proc. Acad. Nat. Sci. Phila.*, May, 1905.

<sup>2</sup> Studies of Gastropoda, II—*Fulgur* and *Sycotypus*, *Am. Nat.*, Vol. 37.

The material at my disposal is very full and complete,<sup>3</sup> and has enabled me to study large series of individuals. These series in each case represent the forms in the proportions in which they occur in the field, and therefore offer every opportunity for obtaining the average racial characters in any particular locality or horizon.

#### MORPHOLOGY.

The genus *Volutilithes* is widely distributed throughout our Southern Eocene. At some localities several sharp and distinct species occur, but at most of the localities *Volutilithes* is represented by one species and by a particular race of that species. The term race is used in place of variety, for in these assemblages the individuals frequently differ widely. There is, however, always an average of characters which stamps the stage of evolution which the race has attained. Of course, extreme specimens often have more of the features of some other race than of the race to which they belong, but these individuals are always few; and there is never any difficulty in recognizing the general race characters for any particular geographical point, and the phase of phylogenetic development found in the faunule at that point. In cases of this sort, the introduction of varietal and specific names is to be deprecated, and the adoption of the system of race analysis is strongly urged by the author.

In the forms under consideration, the first two or three whorls are smooth and rounded, constituting the Smooth Stage. The first ornamental feature to appear on the smooth, rounded whorl is the transverse rib, that is, a slight elevation on the whorl which runs across it from suture to suture. These early ribs are invariably curved slightly, and each one is simple and uniform from suture to suture. The curved ribs persist as a rule for about a quarter or a half of a whorl, or even for a much less space; in fact, sometimes we have only one or two of them. This Curved Rib Stage is short but remarkably constant, and though occasionally much suppressed, has been found in every species and race dealt with in this paper.

The curved ribs, after about one-third of a whorl, change abruptly into the straight ribs of what has been designated the Cancellated<sup>4</sup>

<sup>3</sup> It forms part of the Isaac Lea Collection of Eocene Mollusca at the Academy of Natural Sciences of Philadelphia, and was brought together largely by Mr. Charles W. Johnson, now of the Boston Society of Natural History. The collections are a tribute to his skill and perseverance as a collector, and are an example of what museum research collections should be.

<sup>4</sup> See Dall, *Trans. Wag. Inst.*, Vol. III, p. 68.

Stage, which begins by the appearance of two swellings or tubercles on each rib. One of these tubercles is near the suture, and the other at the position which is later occupied by the shoulder angle. They will be referred to as the suture and shoulder tubercles respectively. These two tubercles are often of nearly equal size at the start, though frequently the suture tubercle is the larger. Tubercles other than these two mentioned are seldom visible on an early rib; but when a sufficiently small shell is obtainable, other smaller tubercles can be seen upon each rib, and the tubercles diminish in size quite regularly from the suture tubercle downward. Each tubercle is connected with the corresponding tubercle of the next rib by a faint spiral, the first appearance of the definite cancellation which later becomes more pronounced. In most specialized forms the shoulder angle develops shortly after the appearance of the tubercles.

The cancellated condition is found more or less well developed in all the different races. In primitive species <sup>5</sup> it may persist as a constant feature to the end of the individual's life; but in most forms it covers only a few whorls and is more variable than the preceding Curved Rib Stage, in that certain of its features change as the shell grows. These changes are gradual, but they render the end of the Cancellated Stage much less definite than its beginning. They may be briefly summarized as follows: The tubercles, with the exception of the shoulder tubercle, usually tend to degenerate, and soon disappear, though their corresponding faint spirals may sometimes persist.

The shoulder tubercle, on the contrary, becomes stronger and sharper. First the ribbing above the shoulder disappears, and later the ribbing below the shoulder shortens, and with its practical disappearance what might be termed the Spiny Stage is inaugurated.

In the Spiny Stage the shoulder tubercle is now sharp and spine-like. Other tubercles have disappeared and the spirals are, as a rule, restricted to the region of the anterior siphon. Ribbing has practically gone, but very short rudiments may sometimes still be present below the shoulder spines. The commencement of this stage is never sharp, for it is the result of gradual change from the preceding one.<sup>6</sup> It is

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<sup>5</sup> In *Am. Nat.* for 1902, Vol. 36, p. 926, Grabau says: "It is perhaps not too much to say that in the majority of the larger phyletic series, except those highly specialized, the radicle is a smooth, round-whorled form, succeeded by types in which the adults are ribbed, and later cancellated, after which progressive modification may be carried further."

<sup>6</sup> No morphological distinction is made between spine and tubercle. "The writer considers that the difference between the small rounded tubercle of the early whorls and the large, sharp spine of the later whorl is one merely of degree.

not reached in all species, but occurs usually as the end term of normal progressive development in the ontogeny, and of slow and even evolution in the phylogeny.

The Spiny Stage, then, may sometimes be present as a well-defined stage, but it may also be accompanied by extreme individual variation and by features of senility. These latter characterize the Senile Stage, and may follow regularly after the Spiny Stage; but, as stated above, they not infrequently are thrown back by acceleration, and found together in the same whorl with the features of the Spiny Stage.

The Senile Stage, whether following normally after the Spiny Stage or associated with it, is always easily distinguished. In the forms under consideration its most important features are the following:<sup>7</sup>

1. Tendency for the shoulder spines to pass into a shoulder keel.
2. Irregularity of growth lines.
3. Thickening of the shell.
4. Encroachment of the anal siphon upward on the preceding whorl.
5. Protrusion of the mantle in the region of the anal siphon, producing a smoothing of the preceding whorl by a shelly overgrowth.

These five characters are all sometimes found together in one individual or race, but, as a rule, only two or three of them are so associated.

In studying the development of the shell features, each whorl has been taken up in detail, and its particular ornamental characteristics noted. Of course, this system is more or less arbitrary, and at times



Fig. 1.—Line shows position taken for the end of the first whorl.

inaccurate, on account of the acceleration of features in certain individuals. In the following study, the writer has endeavored to get the average characters for a certain whorl, except where individual variation is great. In this latter case the variations are noted.

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The word spine is therefore used, throughout this paper, simply in a descriptive sense, and implies no difference from the early tubercle, except that it is larger and sharper. Both are produced by the same fold in the mantle, and every gradation between the two is observable." Smith, Burnett, *Proc. Acad. Nat. Sci. Phila.*, May, 1905, p. 347. This opinion is quite different from that held by Grabau (see *Am. Nat.*, Vols. 36, 37).

<sup>7</sup> For a discussion of senility see Smith, Burnett, *Proc. Acad. Nat. Sci. Phila.*, May, 1905.

In counting the whorls, it has been attempted to have the end of the first whorl come in about the position shown in the figure. It is impossible to make an absolutely exact count, but if care is used there will seldom be much of an error in the last whorl. As stated above, the method is purely arbitrary, but it seemed to the writer to be the only practical way in which the statistics of the development of ornamental features could be arranged.



Fig. 2. — *Volutilithes limopsis* Conrad. Matthew's Landing, Ala. Apex enlarged, showing smooth stage followed by the curved rib stage, which begins in the latter part of whorl four. Whorl five shows the cancellated stage. Length = 1.6 mm.

***Volutilithes limopsis* Conrad.**

Locality—Matthew's Landing, Ala.

This species was originally described by Conrad in *Jour. Acad. Nat. Sci. Phila.*, 2d Series, Vol. IV, p. 292, Pl. 47, fig. 24.

Whorls 1, 2, 3—Smooth and rounded.

Whorl 4—Smooth and rounded, except toward the end, where the curved rib stage may start.

Whorl 5—The curved rib stage often commences early in five, persisting as a rule for about a quarter of a whorl. The cancellated stage follows abruptly with its straight, tubercled ribs. These tubercles are largest at the suture, decreasing regularly in size anteriorly on each rib. Each tubercle is connected with the corresponding tubercle of the next rib by a faint spiral. A shoulder angle is never developed.

Whorls 6, 7—Characterized by the cancellated stage and much like the latter part of five.

Whorl 8—Characterized by the cancellated stage and much like six and seven. The tubercles nearest the suture are the strongest, and they diminish in size regularly as the rib is followed anteriorly. The ribs are also less prominent anteriorly, disappearing entirely on the branchial siphon. Spirals cover the entire whorl.

Whorls 9, 10—Much as in eight, the cancellated stage still persisting.

The tubercles are a little sharp, and the protruded mantle shows a very slight tendency to smooth the preceding whorl—a tendency which in later forms results in a senile feature.

*Remarks.*—This form possesses no stage later than the cancellated stage and never has a shoulder angle. The suture tubercle is throughout life the dominant one. The specimens are remarkably uniform, no perceptible individual variation occurring. The smooth stage is very long. From its primitive characteristics, and its geological position near the base of the Eocene, the writer has no hesitation in assigning to it an ancestral position among the races and species dealt with in this paper.

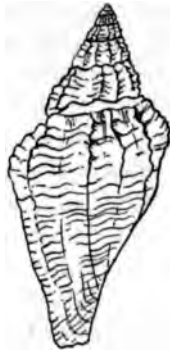


Fig. 3.—*Volutilithes rugatus* Conrad. Matthew's Landing, Ala. Adult individual. Length = 44 mm.

***Volutilithes rugatus* Conrad.**

Locality—Matthew's Landing, Ala.

This species was originally described by Conrad as *Volutilithes rugata* in *Jour. Acad. Nat. Sci. Phila.*, 2d Series, Vol. IV, p. 292, Pl. 47, fig. 32.

Whorls 1, 2, 3—Smooth and rounded.

Whorl 4—Smooth and rounded, except near the end, where in many individuals the curved rib stage begins.

Whorl 5—The curved rib stage usually occupies the latter part of four and early part of five. Its ribs are wide apart and it persists for about a quarter of a whorl. It is followed by the straight, tubercled ribs of the cancellated stage. The two upper tubercles are the largest, those below becoming fainter anteriorly. The ribs die away anteriorly on the branchial siphon. Each tubercle is connected with the corresponding one of the next whorl by a spiral.

Whorls 6, 7, 8—All characterized by the cancellated stage. Changes, however, take place during these whorls. At first the ornamentation is much like that of the cancellated stage in *V. limopsis*, but later the ribs become relatively farther apart and broader (in a spiral direction). At the same time many fine riblets are introduced between the primary ribs. The tubercles are largest near the suture and become smaller as the ribs die away anteriorly. There is never a distinct shoulder angle. The whorls are covered with spirals.

Whorl 9—Individual variation now sets in. In some specimens the whorl is much as in eight. In others the rib is swollen into a very rounded, transversely long angle which hardly occupies the position of the shoulder angle of later forms, and in addition the shells become thick. In all individuals the mantle protrudes in the region of the anal siphon, and tends to smooth the preceding whorl with a shelly overgrowth. This latter is never extreme.

Whorl 10—Much as in nine, though here the forms with swollen ribs predominate. In many specimens the shells become thick, the growth lines irregular, and the smoothing of the preceding whorl by the shelly overgrowth is quite well marked, though it never becomes extreme as in some forms of later time.

*Remarks.*—This species in its earlier stages of growth closely resembles *V. limopsis*. It differs radically, however, from that form with the progress of its ontogeny. Though its individuals vary greatly, it is nevertheless entitled (in the opinion of the author) to rank as a distinct species. In its later whorls there is great individual variation, accompanied by senile features. These latter, though never extreme, are well marked. They comprise protrusion of the mantle in the region of the anal siphon, producing a smoothing of the preceding whorl by a shelly overgrowth; thickening of the shell, and irregularity of growth lines. There is no spiny stage. *V. rugatus* is considered to be a short senile offshoot from *V. limopsis*. In the absence of intermediate forms this evolution must have taken place either at some other locality or at some geologically earlier date.

***Volutilites petrosus* Conrad.**

The forms described at the present day under this name represent an assemblage of races. If every gradation of evolutionary development did not exist among them, many of these races would doubtless now be regarded as distinct species. In fact, there are several discarded specific names which were used in this way by Conrad and Lea. Each race is an assemblage of individuals, showing more or less in-



dividual variation, yet nevertheless possessing on the average definite racial characters. In other words, the majority of specimens from any one locality or horizon show a certain stage of evolution. Some of the specimens may show developmental features characterizing either a more primitive or a less primitive race; but these specimens are few, and are not typical of the average of individuals from the locality or horizon to which they belong.

The races of *V. petrosus* are known to range from the Nanafalia beds to the Jackson beds inclusive. The original specific description<sup>8</sup> is accompanied by a figure of a member of the Claiborne race. Though this particular race is perhaps not the most typical expression of the *V. petrosus* main stock, the writer feels that no better method can be employed than to use the name *V. petrosus* to designate the assemblage of races under discussion.

Several of the races differ in the development of senile characters from the *V. petrosus* main stock, but there is every gradation between these and the representatives of the main stock. On account of this gradation the senile forms are included as races of *V. petrosus*, in spite of the fact that their old individuals differ greatly in appearance from those of the more normal type.

The young of all the races, senile and otherwise, are remarkably uniform and constant. The early whorls indicate clearly that they are all descended from a cancellated ancestor, and bear a strong resemblance, especially in the cancellated stage, to the characters of *V. limopsis*. In the absence of any record of a *V. petrosus* being found below the horizon of the Nanafalia beds, the author believes that it is perfectly safe to conclude that all these races in question are descended from the *V. limopsis* of the Matthew's Landing horizon.

***Volutilithes petrosus* Conrad.**

**Nanafalia Race.**

**Locality—Nanafalia, Ala.**

The only specimen known to the writer from this horizon is not sufficiently well preserved to admit of its accurate study whorl for whorl. It is, however, a perfectly normal specimen of moderate size and expresses the general characters of the *V. petrosus* main stock. It is about the size of the eight-whorled individuals of the Gregg's Landing or the Jackson races. When it is placed in line with such specimens, the three shells exhibit very few differences. This Nanafalia individual

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<sup>8</sup> *Voluta petrosa* Conrad, "Fossil Shells of the Tertiary Formations of North America."

has spines in its last whorl which make it resemble the Jackson race quite closely. In this respect it is nearer the Jackson specimens than the Gregg's Landing specimens. Its mantle perhaps smooths the preceding whorl a trifle more than does the mantle in the Jackson race. However, in its general features, it is very close to the Jackson form. The amount which the mantle has smoothed the preceding whorl is about equal to that found in shells of the same size from Gregg's Landing.

***Volutilithes petrosus* Conrad.**

Gregg's Landing Race.

Locality—Gregg's Landing, Alabama River, Ala.

Whorls 1, 2, 3—Smooth and rounded.

Whorl 4—The curved rib stage begins early in four. It persists for a quarter or a third of a whorl, but changes abruptly into the cancellated stage with its straight, tubercled ribs. The shoulder and suture tubercles are of about the same size at first. By the end of four the shoulder angle is quite well developed.

Whorl 5—Characterized by the cancellated stage and much like the latter part of four. Suture and shoulder tubercles are of about the same size. The shoulder angle is well developed. Tubercles are connected by fine spirals.

Whorl 6—Characterized by the cancellated stage, but changes occur. The shoulder tubercle is becoming stronger, while the suture tubercle is getting weaker. The ribbing above the shoulder angle is also becoming weaker.

Whorl 7—Still characterized by the cancellated stage, but here the suture tubercle has disappeared and is only represented by its spiral. The ribbing above the shoulder angle has gone, though it is still well represented below the shoulder angle.

Whorl 8—Still characterized by the cancellated stage and much like whorl seven. Below the shoulder angle the whorl is covered with fine spirals. There is a very slight smoothing of the preceding whorl by the protruded mantle, for the end of the cancellated stage is not sharp like that of the curved rib stage.

Whorl 9—From here on individual variation is great. Some forms have a whorl much as in eight, with the ribbing still well developed below the shoulder, though the shoulder tubercles are more spine-like. In other specimens the ribbing below the shoulder is gone, the shoulder spines are more extreme, and the anal siphon shows a tendency to encroach upward on the preceding whorl. In addition, these

latter forms have a heavier shell, and the shelly smoothing of the preceding whorl by the protruded mantle is more marked.

Whorl 10—Here again we have every gradation between forms characterized by the spiny stage, in which the preceding whorl has been only slightly smoothed by the mantle, and forms which show a moderate development of senile features. These latter show the tendency for the spines to pass into a shoulder keel. They also possess a thick shell with irregular growth lines, the anal siphon encroaches upward, and the preceding whorl is smoothed by the shelly overgrowth of the protruded mantle. Though these latter forms possess senile features, these features are only slightly developed. They are, in fact, just the beginnings of those characteristics which become so extreme in some of the races of later time.

*Remarks.*—This race occurs in the Gregg's Landing marl. The greater number of individuals of the Gregg's Landing race have a perfectly normal ontogeny, and in their later whorls have the spiny stage well marked. These individuals belong therefore to the *V. petrosus* main stock, and as they form a majority of the assemblage, they determine the position of the race to be on the main stock. A minority of individuals, however, show senile features. These senile features are not well marked, but they indicate that here in this race was inaugurated the tendency which resulted in the development of the senile races of later time. In other words, we have here the point where a senile offshoot is starting to branch from the main ancestral stock. The marks of this tendency are but slight, and the individuals are few; yet, nevertheless, the tendency is plainly recognizable.

*Volutilithes petrosus* Conrad.

Bell's Landing Race.

Locality—Bell's Landing, Alabama River, Ala.

Whorls 1, 2, 3—Smooth and rounded.

Whorl 4—The curved rib stage commences early in four and persists for about a quarter of a whorl. It is followed by the straight, tubercled ribs of the cancellated stage. The suture and shoulder tubercles are about equal in size, and the shoulder angle soon becomes well marked. Spirals connect the tubercles.

Whorl 5—Characterized by the cancellated stage and closely resembles the latter part of four.

Whorl 6—Characterized by the cancellated stage. Suture tubercles grow weaker, shoulder tubercles grow stronger. Ribbing above the shoulder also grows weaker, but it is well marked below the shoulder.

Whorl 7—Much as in six.

Whorl 8—Still characterized by the cancellated stage, but the suture tubercles and the ribbing above the shoulder have now gone. Shoulder tubercles are stronger. Ribbing below the shoulder is weaker. The beginning of the tendency to form a shelly overgrowth is seen, and the cancellated stage comes to an end.

Whorl 9—Ribbing is about gone and the shoulder tubercles have become spines. In other words, the spiny stage has set in. In most individuals, however, the senile characters are also mingled with those of the spiny stage. The shell gets thicker, and the mantle protrudes in the region of the anal siphon, and smooths the preceding whorl with a shelly overgrowth. This latter, though not extreme, often covers the spines of eight, which, however, are visible through it.

Whorls 10, 11, 12—In these whorls we simply have an exaggeration of the characters of nine. The features of the spiny stage and the marks of senility are found together in the same whorl. Toward the end senile characters are quite well marked. The shell becomes thick, the growth lines irregular, the anal siphon encroaches upward, and the shoulder spines tend to pass into a shoulder keel. In addition, the shelly overgrowth produced by the protruded mantle is well marked, and in some specimens may be quite thick. As a rule, however, the spines of the preceding whorl can be counted through the shelly envelope.

*Remarks.*—This race occurs in the Bell's Landing marl. Though occasionally a rare specimen may nearly approach the *V. petrosus* main stock in its general features, the vast majority of individuals show such a development of senile characters that it is necessary to consider the race to be a senile offshoot from the main stem. These senile marks though typical are not highly developed. This race unquestionably sprang from the senile individuals which occurred as a minority in the otherwise normal, geologically earlier Gregg's Landing race.

***Volutilithes petrosus* Conrad.**

**Wood's Bluff Race.**

Locality—Wood's Bluff, Tombigbee River, Ala.

Whorls 1, 2, 3—Smooth and rounded.

Whorl 4—The curved rib stage appears early in four and persists for about a quarter of a whorl. It is followed by the straight, tubercled ribs of the cancellated stage. The suture and shoulder tubercles are about equal in size. A shoulder angle soon develops. The tubercles are connected by spirals.

Whorl 5—Characterized by the cancellated stage and closely resembling the latter part of four.

Whorl 6—Characterized by the cancellated stage. Ribbing above



Fig. 4.—*Volutilithes petrosus* Conrad. Wood's Bluff Race. Wood's Bluff, Ala. Apex enlarged. The first three whorls are characterized by the smooth stage. In whorl four the passage from the curved rib stage to the cancellated stage can be seen. Whorl five shows the cancellated stage. It will be noted that the stages are all more accelerated than in text fig. 2. Length = 1.5 mm.

the shoulder growing weaker, though well marked below the shoulder. Suture tubercles weaker, shoulder tubercles stronger.

Whorl 7—Much as in latter part of six.

Whorl 8—Still characterized by the cancellated stage, but the suture tubercles are gone, and are represented only by their spiral. Ribbing above the shoulder has disappeared, though it is still present below the shoulder. The ribbing below the shoulder is, however, weaker. The tendency to form a shelly overgrowth is plainly seen. Though its end is not well marked, the cancellated stage comes to a close with this whorl.

Whorl 9—The spiny stage usually begins with this whorl. It is, however, accompanied by well-developed senile features, the most marked of which is the shelly overgrowth, which is produced by the protrusion of the mantle on to the preceding whorl.

Whorls 10, 11, 12—Here we have simply an exaggeration of what occurs in nine. The shelly overgrowth is extreme, obscuring the ornamentation of several of the earlier whorls. The shell becomes thick, the growth lines irregular, the anal siphon encroaches upward, and the shoulder spines tend to pass into a shoulder keel.

*Remarks.*—This is typically a senile race. No individuals of more than eight whorls ever approach in their general appearance the *V. petrosus* main stock. All specimens exhibit senile characters. These latter are much more extreme than those found in the geologically

earlier Bell's Landing race. It has unquestionably been evolved from the Bell's Landing race by an exaggeration of senile characters.

*Volutilithes petrosus* Conrad.

Hatchetigbee Bluff Race.

Locality—Hatchetigbee Bluff, Tombigbee River, Ala.

The series of young individuals at hand is so small, and the shelly overgrowth produced by the protruded mantle is so great in the old individuals, that a detailed study of the specimens, whorl for whorl, is not practical.

These forms are extraordinarily senile, and have been derived from the geologically earlier Wood's Bluff race by an exaggeration of the senile features. The shoulder spines tend to pass into a shoulder keel, the shell is thick, the growth lines irregular, the anal siphon encroaches upward, and the preceding whorl is encumbered with the shelly overgrowth. This last feature is very extreme. In addition the race is, on the whole, a dwarfed race, the full-grown individuals being smaller than those of the earlier less senile races. This race is the end term of the senile offshoot which diverged from the *V. petrosus* main stock in Bell's Landing time. The author knows of no authentic abnormal senile specimen from beds higher than the Hatchetigbee horizon in Alabama or Mississippi.<sup>9</sup>

*Volutilithes petrosus* Conrad.

Yellow Bluff Race.

Locality—Yellow Bluff, Alabama River, Ala.

Unfortunately the material at hand is not sufficiently well preserved to give a detailed description, whorl for whorl. Nevertheless, there is no difficulty in making out the following points. The great majority of individuals possess, in general, the characters of the *V. petrosus* main stock, and have arrived at little more than that evolutionary stage which is typified by the Gregg's Landing race.

Though a few individuals exhibit senile characters, these latter are only very slightly developed, and we are undoubtedly warranted in placing the Yellow Bluff race on the *Volutilithes petrosus* main stock as the descendant of the Gregg's Landing race.

The exact stratigraphical horizon for this race is unknown to the

<sup>9</sup> See *Trans. Wag. Inst.*, Vol. III, part 1, p. 75. The statement made on this page by Dall is not borne out by a study of full collections. He says that *Athleta* "is foreshadowed by the distorted specimens of *Volutilithes petrosa* to which I have already referred, and which occur from the Lower Eocene of Alabama (Wood's Bluff) up to the Claiborne Sands and the beds known as Jackson, overlying the Claiborne, associated with the undistorted normal form, which is always more numerous."

author. It cannot, however, be lower than that of the Bell's Landing marl. If it is at the same horizon, we have an example of a slightly senile race (the Bell's Landing) living at the same period of time not far from a race (the Yellow Bluff) which exhibits, on the whole, main stock characteristics. If, on the other hand, the Yellow Bluff race occupies a position above the Bell's Landing marl, we have a primitive race overlying a more specialized race. If this latter is the case, a discordance between the geological and phylogentic successions has been produced by the migration into the section of the Yellow Bluff race.

*Volutilithes petrosus* Conrad.

Lower Claiborne Horizon, Claiborne, Ala.

Very poorly preserved specimens are found in these beds. They are determinable as representatives of the *V. petrosus* main stock, but a detailed study, whorl for whorl, is not practical.

*Volutilithes petrosus* Conrad.

Claiborne Race.

Locality—Claiborne, Ala.

Whorls 1, 2, 3—Smooth and rounded.

Whorl 4—Early in four the curved rib stage appears. It is not well marked, persisting for but a short time, and is soon followed by the straight, tubercled ribs of the cancellated stage. The shoulder angle soon develops. The suture and shoulder tubercles are of about the same size.

Whorl 5—Characterized by the cancellated stage and much as in the latter part of four. Spirals not strong. Suture tubercle weakens, shoulder tubercle becomes stronger.

Whorl 6—Characterized by the cancellated stage. The suture tubercle and the ribbing above the shoulder are almost gone. Shoulder tubercle stronger. Ribbing below shoulder is weaker.

Whorl 7—The ribbing and the suture tubercles disappear, and the shoulder tubercles develop into spines during this whorl. In other words, we have the transition from the cancellated to the spiny stage.

Whorls 8, 9, 10—All characterized by the spiny stage, but individual variation is great. Senile features do not appear.

*Remarks.*—Occurs in the Claiborne Fossiliferous Sand. This race exhibits in general the characters of the *V. petrosus* main stock, though it is probably not the most typical expression of that stock as it existed at the time of the Claiborne deposits. The most notable features are the shortening of the curved rib stage and the acceleration of the spiny

stage, which is long and well developed though accompanied by considerable individual variation. The curved rib and cancellated stages are very short.



Fig. 5.—*Volutilithes sayana* Conrad. Claiborne, Ala. Apex enlarged, showing ornamental features thrown far back by acceleration. The smooth stage is almost entirely confined to the large first whorl. In whorl two the transition from the straight untubercled ribs (suppressed curved rib stage) to the cancellated stage is seen. Whorl three shows the cancellated stage. Length = 1.8 mm.

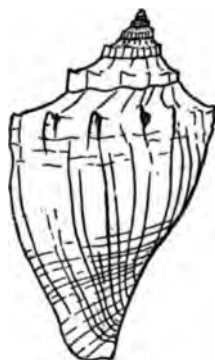


Fig. 6.—*Volutilithes sayana* Conrad. Claiborne, Ala. Adult individual. Length = 48 mm.

***Volutilithes sayana* Conrad.**

Locality—Claiborne, Ala.

This species was originally described as *Voluta sayana* by Conrad.<sup>10</sup>

Whorl 1—Smooth and rounded.

Whorl 2—Smooth and rounded at first, but soon ribbing begins. Untubercled ribs are the first ribs, but they are not curved. Neverthe-

<sup>10</sup> *Fossil Shells of the Tertiary Formations of North America.*



less they probably represent the curved rib stage and will be assigned to it. They persist for only a short while and are followed by the tubercled ribs of the cancellated stage. At first the suture tubercle is considerably larger than the shoulder tubercle. A shoulder angle soon develops, and by the end of the whorl the suture and shoulder tubercles are about of the same size.

Whorls 3, 4—Characterized by the cancellated stage and much as in latter part of two. Changes however occur, for the ribbing above the shoulder and the suture tubercles weaken, though the shoulder tubercle becomes stronger. The spirals are not well marked.

After whorl four great individual variation sets in. The cancellated stage may persist through the sixth whorl. After this the individual variation is still more marked. Many specimens pass through the spiny stage, though it is considerably modified by the development of numerous secondary spirals and riblets. In many specimens the shoulder spines are long in a transverse direction and notched by several spirals. Sometimes the whorl may be of a rounded shape, with the spines blunt, weak and obscure.

*Remarks.*—Occurs in the Claiborne Fossiliferous Sand. This most variable species has an apex very different from those of the other forms considered in this paper. The smooth stage is nearly all confined to the first whorl, which is extraordinarily large for *Volutilithes*. By a careful study of its ontogeny it is plain, however, that this species was derived by acceleration from the Claiborne race of *V. petrosus*, or else from some form very close to it. We are forced, then, to the conclusion that shells with rather different apices may sometimes be very nearly related; in spite of the fact that, as a rule, this condition precludes close affinity. Though this variable species may have given rise to species and races of later age than the Claiborne, the writer has no evidence to that effect. The anal siphon does not encroach upward, and the protruded mantle smooths the preceding whorl but little; nevertheless, the thickness of the shell and the irregularity of growth lines in many of the older individuals point to the fact that it is a senile race. It is well developed in the Claiborne horizon at several points, where it is always variable and more numerous than the Claiborne race of *V. petrosus*. From this latter race it was probably evolved during or just before Claiborne time, and may therefore be considered as a senile offshoot from the *V. petrosus* main stock.

*Volutilithes petrosus* Conrad.

Jackson Race.

Locality—Jackson, Miss.

An individual of this race was originally described by Conrad as *Volutilithes symmetrica*.<sup>11</sup>

Whorls 1, 2—Smooth and rounded.

Whorl 3—The curved rib stage commences early in three and persists for about a quarter of a whorl. It is followed by the straight tubercled ribs of the cancellated stage. The suture and shoulder tubercles are about equal in size. By the end of the whorl the shoulder angle is well marked.

Whorls 4, 5—Characterized by the cancellated stage. Ribbing above the shoulder weakens, as does also the suture tubercle. Shoulder tubercle gets stronger. Ribbing below the shoulder well marked and crossed by fine spirals.

Whorl 6—Characterized by the cancellated stage and much as in five.

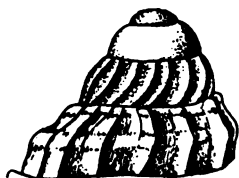


Fig. 7—*Volutilithes petrosus* Conrad. Jackson Race. Jackson, Miss. Apex enlarged. Whorls one and two show the smooth stage. Whorl three shows the curved rib stage and whorl four the cancellated stage. It will be noted that the stages are all more accelerated than in text fig. 4, but less accelerated than in text fig. 5. Length = 1.3 mm.

Whorl 7—Characterized by the cancellated stage. Ribbing gone above the shoulder, but well developed below the shoulder, and crossed by fine spirals. Suture tubercles almost gone though represented by a spiral. Shoulder tubercle stronger and sharper.

Whorl 8—Much like seven, but toward the end the ribs disappear, the shoulder tubercle becomes a spine, and the cancellated stage comes to a close.

Whorl 9—Characterized by the spiny stage. High shoulder spines and no ribs. Spirals well developed, but strongest on the anterior siphon.

Whorl 10—In many individuals the shoulder spines tend to pass into a shoulder keel, the shell thickens, and the growth lines become irregular. The shelly smoothing of the preceding whorl by the protruded mantle is only slight. This whorl is characterized by the senile stage.

<sup>11</sup> *Proc. Acad. Nat. Sci. Phila.*, Vol. VII, p. 260. In this case "*Volutilithes*" is probably a typographical error.

*Remarks.*—This race shows a regular and even ontogeny. The different stages are quite distinct. The senile characters are not thrown back into the spiny stage but follow regularly after it, and constitute the culminating feature of individual development. These marks of old age are never extreme. Acceleration early in life has placed the curved rib stage at the beginning of the third whorl, and the cancellated stage has been correspondingly lengthened. The cancellated stage is longer here than in any of the other forms considered in this paper except *V. limopsis*. This assemblage is the last representative of *Volutilithes* in the Alabama and Mississippi Eocene. It fulfills every requirement for position on the *V. petrosus* main stem, it is the culminant race of the stock, and has attained its characters by a slow and even phylogenetic development.

*Volutilithes haleanus* Whitfield.

Locality—Lisbon, Ala.

Whorls 1, 2—Smooth and rounded.

Whorl 3—Smooth and rounded at first, but later the curved rib stage begins. This persists for about a quarter of a whorl, and is then followed by the straight, tubercled ribs of the cancellated stage. The shoulder tubercle is just a trifle larger than the suture tubercle. The shoulder angle is well marked by the end of the whorl.

Whorl 4—Characterized by the cancellated stage. Shoulder angle. Shoulder tubercle stronger than the suture tubercle.

Whorls 5, 6—Characterized by the cancellated stage and much like whorl four. During these whorls the suture tubercle tends to attain the same strength as the shoulder tubercle. Spirals not very well marked.

Whorl 7—From here on the primitive cancellated stage is replaced by what may be called a modified cancellated stage. The suture and shoulder tubercles are now of about the same size. The ribs are crowded so closely together that they are almost in contact, being separated by a mere depressed line. The shoulder tubercles are so close together that the general effect is that of a whorl with a shoulder keel.

Whorls 8, 9—Much as in seven, but toward the end the shell becomes thick and the growth lines slightly irregular. The protruded mantle produces only an insignificant smoothing of the preceding whorl.

*Remarks.*—By a study of its early whorls it is evident that this form was at some time derived from the *V. petrosus* main stock. Its cancellated stage closely resembles that of the races of *V. petrosus* until we reach the seventh whorl. After that it is quite different in its general

characters from every other American species of *Volutilithes*. Just when it diverged from the *V. petrosus* main stock the writer is not prepared to say. This race has, properly speaking, no senile stage.

In order to show more clearly some of the important correlations between the ontogeny and phylogeny, the following tables are introduced. The figures stand for the number of the whorl, while the letters are used for the different ontogenetic stages as follows:

- A—Smooth Stage.
- B—Curved Rib Stage.
- C—Cancelled Stage.
- D—Spiny Stage.
- E—Senile Stage.
- I—Individual Variation.

This last may appear anywhere, but it usually follows stage C. B is exaggerated in all the tables. .

	1	2	3	4	5	6	7	8	9	10	11	12	
<i>V. limopsis</i> . Matthew's Ldg.			A	B <sub>1</sub>				C					
<i>V. petrosus</i> . Gregg's Ldg. Race.		A		B <sub>1</sub>		C			D and I				E. is very slight.
<i>V. petrosus</i> . Jackson Race.		A	B <sub>1</sub>			C			D	D and E			E. is never extreme

TABLE I.—Showing slow, even evolution in the main stock, accompanied by acceleration.

	1	2	3	4	5	6	7	8	9	10	11	12	
<i>V. limopsis</i> . Matthew's Ldg.			A	B <sub>1</sub>				C					
<i>V. petrosus</i> . Gregg's Ldg. Race.		A		B <sub>1</sub>		C			D and I				E. is very slight.
<i>V. petrosus</i> . Bell's Ldg. Race.		A	B <sub>1</sub>			C				D and E			E. is slight.
<i>V. petrosus</i> . Wood's Bluff Race.		A	B <sub>1</sub>			C				E and D			E. is extreme.

TABLE II.—Showing senility in an offshoot. The senility increases, not by an acceleration, but by an exaggeration of senile features.

	1	2	3	4	5	6	7	8	9	10	11	12
<i>V. limopsis.</i> Matthew's Ldg.			A	B <sub>1</sub>				C				
<i>V. petrosus.</i> Gregg's Ldg. Race.			A	B <sub>1</sub>			C			D and I		
<i>V. petrosus.</i> Claiborne Race.			A	B <sub>1</sub>			C			D and I		
<i>V. sayana.</i> Claiborne.			A	B <sub>1</sub>			C			D and I		

E. is very slight.  
I. is great.  
D. is much modified. I. is great.

TABLE III.—Evolution of *V. sayana* through the Claiborne race of *V. petrosus*. Shows general acceleration, condensation of B, and reduction in the number of whorls.

	1	2	3	4	5	6	7	8	9	10	11	12
<i>V. limopsis.</i> Matthew's Ldg.			A	B <sub>1</sub>				C				
<i>V. rugatus.</i> Matthew's Ldg.			A	B <sub>1</sub>				C		I, E		

I. is the transition between C. and E

TABLE IV.—Shows evolution of *V. rugatus* from the primitive ancestral stock by the appearance of senile features in the last whorl or in the last two whorls.

#### RANGE AND DISTRIBUTION.

Of the forms considered in this paper *Volutilithes limopsis* stands out distinctly as fulfilling all the requirements of an ancestor. Among other characters, the long smooth stage and the absence of senile features show its primitive state. The general likeness of the full-grown shells to the young of many later species, together with its low geological position, justifies us in considering it to be the form from which were descended the races which followed Matthew's Landing time.

In the same horizon with *V. limopsis* we find *V. rugatus*. The young of the latter show many of the features of the adult *V. limopsis*, while the old individuals are often slightly senile and quite different in appearance from the small specimens. It was undoubtedly derived from *V. limopsis*, or some closely allied form, and may be considered a short senile offshoot which did not survive the Matthew's Landing.

In the Nanafalia the first member of the *Volutilithes petrosus* assemblage makes its appearance, and is representative of the *V. petrosus* main stock. After the Nanafalia the races of *V. petrosus* are a prominent feature of the faunas. Though the adults of these races may differ greatly, the young resemble each other closely, and indicate their common derivation from *V. limopsis*.

In the Gregg's Landing marl, the Gregg's Landing race represents the *V. petrosus* main stock, though a few of its individuals show slightly senile tendencies. In the Bell's Landing marl the Bell's Landing race has separated from the main stock with the evolution of senile features. It is the first member of a senile offshoot which in later time produces the Wood's Bluff and Hatchetigbee Bluff races. These latter are evolved from the Bell's Landing race, not so much by an acceleration as by an exaggeration of the marks of senility. The Hatchetigbee Bluff race is without descendants and the last term of this senile series. Its individuals are dwarfed and stunted, reflecting plainly the unfavorable conditions under which they lived, and which soon caused the extinction of the race.

While in some localities the members of the *Volutilithes petrosus* assemblage were following out a line of evolution which resulted in their elimination from the geological record, the main stock was still flourishing in nearby regions. For instance, at Yellow Bluff on the Alabama river we have a representative of the *V. petrosus* main stock. The Yellow Bluff race is indicative of favorable conditions at that locality.

In the Lower Claiborne the *V. petrosus* main stock occurs, though it is represented only by a few poorly preserved specimens. The Claiborne, however, not only gives us the Claiborne race but an offshoot from it, namely, *V. sayana*. This Claiborne race is an assemblage of rather accelerated and variable forms which probably express the effect of shallow water marine conditions upon the main stock. By an acceleration of ornamental features *V. sayana* was derived either from the Claiborne race or from some very closely related form.

Passing now into the Jackson, we find the last member of this phylogenetic series which we have traced up from the Matthew's Landing horizon. It is the Jackson race of *V. petrosus*. This form is the result of the slow and even evolution of the ancestral race which took place in the favorable conditions of a more open sea. Its ontogeny is normal, each stage following its predecessor in regular fashion. Though this form is accelerated, there is little mingling of the senile and spiny characters by unequal acceleration. The senile stage closes a well-

developed spiny stage. This race of *V. petrosus* differs but slightly from the form which we saw in the Nanafalia beds, and demonstrates clearly how little a stock may vary through a long period of time if it is living under favorable conditions.<sup>12</sup>

The phylogeny of the Alabama and Mississippi species of *Volutilithes* may be represented by the table on p. 74. The Yellow Bluff race is provisionally placed in the Bell's Landing horizon.

#### SUMMARY.

From the Matthew's Landing to the Hatchetigbee inclusive the strata belong to the so-called Lignitic formation. They consist of thick deposits of cross-bedded sands and clays, often glauconitic, and of lignites alternating with thin beds of marine fossils.<sup>13</sup> It is evident that these deposits were formed in a great shallow arm of the sea, whose waters were sometimes fresh or blackish and at others salt.

The marine faunas which from time to time invaded this Lignitic gulf brought with them, at first, species and races of *Volutilithes* with normal aspect. These, however, only represent the dwellers on the edge of the respective *Volutilithes* communities, the centres of which were farther out in the open sea. These forms which were subjected to the conditions of the Lignitic eventually followed out a course of evolution which was a direct reflection of their unfavorable environment. The races of *Volutilithes petrosus* at Bell's Landing, Wood's Bluff, and Hatchetigbee Bluff make such a series, in which the senility becomes more and more extreme with the course of time.<sup>14</sup>

Occasionally throughout the later Lignitic, as at Yellow Bluff, we find a race which has migrated from a more favorable environment, and which resembles the primitive races of earlier Lignitic waters, as those of Gregg's Landing and Nanafalia. The grade of phylogenetic development which the Yellow Bluff assemblage has attained also

<sup>12</sup> The author has seen forms purporting to come from the Vicksburg horizon which appear to be poorly preserved examples of the Jackson race of *V. petrosus*. He does not, however, feel justified (without further evidence) in carrying the range of *V. petrosus* above the Jackson horizon.

<sup>13</sup> *Bull. 43, U. S. G. S.*, "Tertiary and Cretaceous Strata of the Tuscaloosa, Tombigbee, and Alabama Rivers," Eugene A. Smith and Lawrence C. Johnson.

<sup>14</sup> It is to be noted in this connection that forms occur in the Miocene of Europe which appear to belong to *Volutilithes* and to possess the shelly overgrowth. The abnormal American races are produced by local conditions, that is, by those of the Lignitic, and are widely separated not only geographically but geologically from the European specimens. It is therefore highly improbable that the European forms (if they are *Volutilithes* at all) are descended from the American ones. In the absence of more definite information, we are justified in regarding the phenomenon as one of parallelism.





indicates that a normal, slow, and even evolution has been going on in one locality; while at the same time rapid, senile evolution has taken place among forms subjected to unfavorable conditions in another region.

Where, then, was the centre of this normal phylogeny? We may well look toward the open sea to find this favorable environment, and the deposits which follow the Hatchetigbee beds furnish us with the desired answer.

With the inauguration of the Lower Claiborne began that movement which finally resulted in the deepening of the sea and the production of the white limestone of the Jackson. The brackish water conditions disappear and are replaced by those of a shallow water (but typically marine) environment. The Claiborne race of *Volutilithes petrosus* shows the effect of such conditions upon the main stock. The sinking of the sea-bottom proceeded throughout Claiborne time, and finally the Jackson limestone with its relatively deep water fauna is introduced. The Jackson race of *V. petrosus* represents the result upon the main stock of slow and even evolution in a favorable environment.

It follows, then, that every stock has some particular set of conditions in which it develops normally. Contemporaneously with this normal phylogeny a senile evolution in the same stock may occur at some less favored locality. In the forms we have considered the environment most favorable to a slow and even evolution is an open sea one, in which limy deposits are forming. It is only, then, in a thick limestone deposit that we could expect to find all the phylogenetic stages of the *Volutilithes petrosus* main stock and other primitive species. In conclusion it is interesting to note that one of the only two existing species of the genus, namely, *Volutilithes abyssicola* Adams and Reeve,<sup>15</sup> is a cancellated form which apparently is quite close in its grade of evolutionary development to the ancestral *V. limopsis* of remote Eocene time. This recent species is found in relatively deep water off the Cape of Good Hope, and probably is a member of a primitive stock, which in the favorable environment of a deep and open sea has been able to persist long after its nearest relatives have become extinct.<sup>16</sup>

The writer wishes to express his indebtedness to Prof. Henry A. Pilsbry, of the Academy of Natural Sciences of Philadelphia, and to Prof. Amos P. Brown, of the University of Pennsylvania, for many

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<sup>15</sup> *Zoology of the Voyage of the Samarang.*

<sup>16</sup> See Dall, *Trans. Wag. Inst.*, Vol. III, p. 74.

helpful suggestions, and to Miss Helen Winchester for care exercised in making the drawings. In addition the writer wishes to especially acknowledge the kindness of Mr. Charles W. Johnson, of the Boston Society of Natural History, in giving him much valuable information in regard to the range and distribution of the races and species.

#### EXPLANATION OF PLATE II.

- Fig. 1. *Volutilithes limopsis* Conrad. Matthew's Landing, Ala. Adult of moderate size showing the persistence of the cancellated stage throughout the later whorls. Length—18.5 mm.
- Fig. 2. *Volutilithes rugatus* Conrad. Matthew's Landing, Ala. Young individual showing the cancellated stage. With the exception of the last whorl, the sculpture is very much like that of *V. limopsis*. Length—19.5 mm.
- Fig. 3. *Volutilithes petrosus* Conrad. Bell's Landing Race. Bell's Landing, Ala. Young individual showing the cancellated stage. Length—20 mm.
- Fig. 4. *Volutilithes petrosus* Conrad. Jackson Race. Jackson, Miss. Young individual showing the cancellated stage. Length—19 mm.
- Fig. 5. *Volutilithes petrosus* Conrad. Gregg's Landing Race. Gregg's Landing, Ala. Adult individual showing the general characters of the *V. petrosus* main stock. The later whorls show the spiny stage. Length—50 mm.
- Fig. 6. *Volutilithes petrosus* Conrad. Yellow Bluff Race. Yellow Bluff, Ala. Adult individual showing the general characters of the *V. petrosus* main stock. This is, however, not as typical an expression of the features of the main stock as is seen in fig. 5. The later whorls show the spiny stage. Length—44 mm.
- Fig. 7. *Volutilithes petrosus* Conrad. Jackson Race. Jackson, Miss. Adult individual showing the general characters of the *V. petrosus* main stock. The later whorls show the spiny stage. This is the culminant type of the main stock. Length—52 mm.
- Fig. 8. *Volutilithes petrosus* Conrad. Bell's Landing Race. Bell's Landing, Ala. Adult individual showing the slightly developed senile characters. Length—52 mm.
- Fig. 9. *Volutilithes petrosus* Conrad. Wood's Bluff Race. Wood's Bluff, Ala. Adult individual showing strongly developed senile characters. Length—58 mm.
- Fig. 10. *Volutilithes petrosus* Conrad. Hatchetigbee Bluff Race. Hatchetigbee Bluff, Ala. Adult individual showing extreme senility and dwarfed size. This is the culminant type of the senile offshoot shown in figs. 8 and 9. Length—43 mm.

**SOME COLD-BLOODED VERTEBRATES OF THE FLORIDA KEYS.**

BY HENRY W. FOWLER.

During June of 1904 the writer, accompanied by Mr. Stewardson Brown, of the Botanical Section of the Academy, was enabled through the generosity of Mr. Clarence B. Moore to visit the Florida Keys. The chief object of the expedition was to explore the islands for land snails of the genus *Liguus*. Incidentally we were enabled to study the flora and fauna of this most interesting region. We availed ourselves of every opportunity to gather information, but only data which I feel to be absolutely reliable is here included. The vernacular names of the different species, so far as I could judge, are those of the fishermen and residents.

Our operations extended from between a point directly south of Cape Sable, or from Grassy Key west to the Marquesas, covering an area about fifty miles in length. We did not visit the Tortugas, which are the most western of the Keys and more isolated than the Marquesas. Making Key West our headquarters, we set out after exploring that island for the Marquesas, stopping at Boca Grande Key on our way. The Marquesas bank comprises a number of islands, disposed in a more or less circular or atoll-like manner with great shallows all about, though mostly inside. Few places we visited repaid us as well as these islands. On our return we skirted the southern shores of the Keys toward Key West, stopping at Ballast Key. We then left Key West again and travelled along the southern shores of the Keys eastward to Grassy Key, stopping at Boca Chica, Sugar Loaf, Big Pine, No Name, Cudjoe's, Knight, Vaca and Grassy Keys. On our return, which was along the northern shores of these islands, we stopped at Vaca, Bahia Honda, Hailer's Rock, Little Pine, Big Pine, Summerland, Cudjoe's, Sugar Loaf, West Cudjoe's, Riding, Snipe and Jewfish Keys. Most of the Keys are more or less covered with mangroves; others, such as Big and Little Pine, have large tracts of pine forest with an undergrowth of scattered palmettos. The latter grow several feet in height, and in combination with the pines present a beautiful contrast after the monotony of mangroves. All of the islands are low, rising but a few feet above the sea-level, and most all are furnished

with rather broad white sandy beaches. Some places along these beaches are studded with mangroves, affording excellent shelter, when overhanging, for many fishes. Along a number of the Keys were flat embankments covered with long grass, and in other places coconut groves, as that on Boca Chica Key. Many Keys were covered with more fertile areas in which various tropical plants, shrubs and trees were found in abundance, often studded here and there with cacti, and sometimes presenting an impenetrable barrier. Throughout the Keys we visited the water is comparatively shallow. In some places reefs are formed where the most beautiful of tropical marine animal life abounds in luxuriance. Most of these places, we were informed, are constantly though gradually shifting, so that new charts are needed from time to time to show the changes in depth and topography. Some of the shallows are left entirely dry by the tides, and others are covered with large beds of sea-wrack. In such places many wading-birds find an abundant supply of food. We found a few pools on certain of the larger Keys, such as Big Pine, Summerland and Little Pine. They are of rather brackish-water, though I did not taste of all.

Hailer's Rock is a small flat or low island of sand-heaped rocks, with a growth here and there of a few low bushes. The southern end is of bare dry rocks running well out to sea and leaving numerous tide-pools. These pools vary in size and depth from some of a few inches in extent to others of several feet. Here such gaudy and tropical fishes as the Cock Eye Pilot, Sheep's Head, Rock Fish, and School-master were found. The Rock Fish, or Gobies and Blennies, are colored much like their surroundings, and trust in great part to this for concealment. Some are pale and others are dark. They dart swiftly from place to place when disturbed, much after the manner of our own Darters, or else hide in crevices. Though they were active, I secured a number by hand with a little trouble.

While off Key West we saw cetaceans, evidently a species of *Delphinus*. The Opossum and Raccoon were reported from Key West, and the latter also from Sugar Loaf, Big and Little Pine Keys. I saw a Rabbit on Big Pine Key and a Deer on Sugar Loaf. Deer were found formerly on Little Pine Key, but were now believed to be absent. Though I did not see the Wood Rat on Summerland Key, I was informed that they sometimes climb the trees to feed on fruits, such as the sapadilla.

## FISHES.

## GINGLYMOSTOMIDÆ.

1. *Ginglymostoma cirratum* (Gmelin). Shark.

Very abundant in all warm shallows about the Marquesas. At this season (June) they come in these places to copulate, and I was informed that they do not occur here, or at least were rarely seen, at other times for this purpose. I saw a male and female in coitus. On one occasion about four males were seen swimming close about a female, whose whitish belly could be seen quite a distance, as she was back down. She was also evidently awaiting their initiative. I approached in a small boat till almost directly above, when it was possible to prod them with an oar as they swam slowly about and but little agitated. A pair will remain fastened together some little time, and then suddenly part without much commotion. Their location may easily be determined in these places by a portion of the dorsal fin, and frequently also a part of the caudal, projecting above the surface. The term "cooting," employed by some fishermen for the act of copulation among these sharks, may possibly have been derived from the word courting.

Examples vary somewhat in color, some appearing pale cinnamon, though they are always distinguishable quite a distance, even when entirely under water. All I observed were large, nearly twelve or fourteen feet in length, and were not at all shy. Occasionally in shallow water, especially like that along the southern shores of Ballast Key, they were sometimes more or less exposed or with both caudal fins well out of the water when copulating.

## ALOPIDÆ.

2. *Alopias vulpes* (Gmelin). Fish Shark.

Reported to be rather numerous at times in and about the Keys. They were said to feed almost entirely on fish.

## GALEIDÆ.

(*Galeus* Klein, in Walbaum, Pet. Arted. Gen. Pisc., III, 1792, p. 580. Type *Squalus galeus* Linnæus = *Galeorhinus* Blainville, 1816-17.)

3. *Cynais canis* (Mitchill).

A small Shark was seen in the shallow water about Sugar Loaf Key.

4. *Galeocerdo tigrinus* Müller and Henle.

Reported as sometimes taken during summer.

5. *Carcharhinus lamia* (Rafinesque).

Large examples of some species of *Carcharhinus*, most likely this species, were reported under the name "Man Eater." I did not see any examples or hear any reports of *Scoliodon terraenovae* (Richardson), unless it was confounded with the present form.

## CESTRACIONTIDÆ.

(*Cestracion* Klein, in Walbaum, Pet. Arted. Gen. Pisc., III, 1792, p. 580.

Type *Squalus rygana* Linnæus = *Sphyrna* Rafinesque, 1810.)

6. *Cestracion tiburo* (Linnæus). Bonnet Head Shark.

Reported as rather abundant.

7. *Cestracion rygana* (Linnæus). Hammer Head. Hammer Head Shark.

The large examples which occur about Bahia Honda Key are said to attain at least fifteen or more feet in length. *C. tiburo* is said to be small. Both species were reported as more abundant in summer.

## RHINIDÆ.

(*Rhina* Klein, in Walbaum, Pet. Arted. Gen. Pisc., III, 1792, p. 580. Type *Squalus squatina* Linnæus = *Squatina* Dumeril, 1806.)

8. *Rhina squatina* (Linnæus).

Occasionally taken in summer.

## PRISTIDÆ.

9. *Pristis pectinatus* Latham. Saw Fish.

Reaches a considerable size. Young rather common in the shallows.

## NARCACIONTIDÆ.

(*Narcacion* Klein, in Walbaum, Pet. Arted. Gen. Pisc., III, 1792, p. 580.

Type *Raja torpedo* Linnæus = *Narcobatus* Blainville, 1816.)

10. *Tetronarce occidentalis* (Storer). Electric Fish.

Found occasionally associated with species of *Dasybatus*.

## DASYBATIDÆ.

(*Dasybatus* Klein, in Walbaum, Pet. Arted. Gen. Pisc., III, 1792, p. 581.

Type *Raja pastinaca* Linnæus = *Dasyatis* Rafinesque.)

11. *Dasybatus hastatus* (De Kay). Sting Ray.

Color in life pale hair-brown above, margin of disk paler or more or less narrowly whitish, and submarginally a slightly darker shade than general color of body. Tail blackish-brown, spine dark. Lower surface of body white. Iris brown.

This species was seen several times about the shallows of the Mar-

quesas. When swimming they appear to glide over the sand, from which they are distinguished with difficulty when quiet. They usually swim rapidly away upon the approach of a small boat, though we captured a single example with the harpoon. They were found in pairs, and seldom attained more than a couple of feet in width of disk.

#### PSALLISOSTOMIDÆ.

(*Psallisostomus* Klein, in Walbaum, *Pet. Arted. Gen. Pisc.*, III, 1792, p. 581. Type *Esox osseus* Linnaeus.)

12. *Psallisostomus osseus* (Linnaeus). Common Gar.

Reported from about the Keys south of Cape Sable, but not seen by me.

#### ELOPIDÆ.

13. *Tarpon atlanticus* (Valenciennes). Tarpon.

This fish is reported to be used for food by the negroes at times. It is the custom of anglers to throw their bodies on the beach or shore, as it is said they attract the sharks if allowed to stay in the water, thus interfering with the fishing. The young were said to be not quite so common, though it is possible that they may have been overlooked.

14. *Elops saurus* Linnaeus. Ten Pounder.

Said to be abundant at times.

#### ALBULIDÆ.

15. *Albula vulpes* (Linnaeus). Bone Fish.

Mostly abundant.

#### DUSSUMIERIIDÆ.

16. *Jenkinsia stollifera* (Jordan and Gilbert). Fig. 1.

Head  $3\frac{1}{2}$ ; depth 5; D. III, 8; A. I, 14; P. II, 11; V. I, 6; scales 30? (according to pockets) in a lateral series to base of caudal, and about 4 more on latter; about 8? series of scales transversely between origin of dorsal obliquely back behind origin of ventral; width of head about 2 in its length, and depth of head a trifle less; length of depressed dorsal  $1\frac{1}{2}$ ; base of anal 2; length of caudal (damaged)  $1\frac{1}{2}$ ; pectoral  $1\frac{3}{4}$ ; ventral 2; least depth of caudal peduncle  $3\frac{3}{4}$ ; mandible  $2\frac{1}{8}$ ; snout  $3\frac{1}{2}$ ; orbit 3; interorbital space 4; maxillary  $2\frac{1}{4}$ .

Body long, compressed, profiles similar and not trenchant. Greatest depth at origin of dorsal. Caudal peduncle compressed, and its length about equal to its depth.

Head large, deep, compressed, upper profile curved a little from tip of upper jaw and then straight after middle of orbit, and lower profile forming a broad angle below front of orbit. Snout short and rounded. Eye large, rounded, almost impinging on upper profile and anterior. Adipose eyelid covering greater part of orbit. Mouth terminal and a little superior, small, and mandible projecting a little in front. Maxillary well inclined, distally broadly expanded till about equal to  $\frac{1}{4}$  of pupil, and its posterior edge not quite reaching opposite same. Teeth in jaws minute, and if present on roof of mouth and tongue very small or indistinct. Tongue small, a little elongate, and with free rounded tip. Each ramus of mandible well elevated inside mouth. Interorbital space rather narrow and flat. Nostrils close together, and about midway in length of snout. Preorbital rather

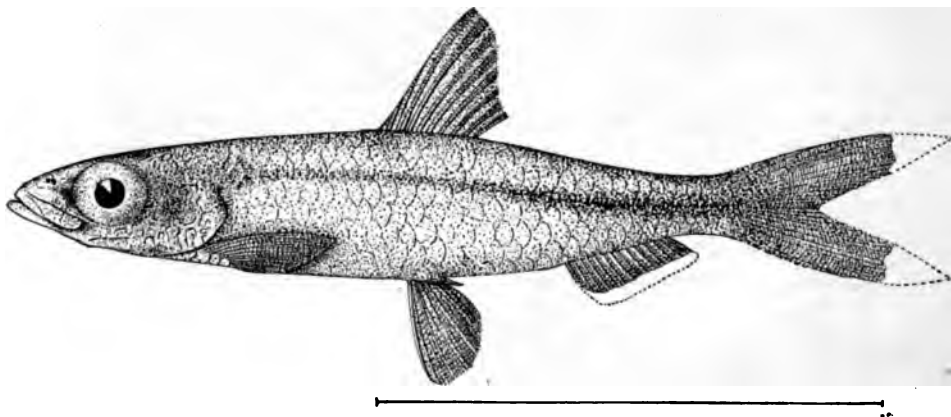


Fig. 1. *Jenkinsia stoliifera* (Jordan and Gilbert).

narrow and together with infraorbital, preopercle and opercle furnished with rather large arborescent flutings, those on latter with more or less adipose substance above. Opercle with a gash in upper posterior margin. Articular surface of mandible below its articulation with a broad obtuse spine or denticle.

Gill-opening carried forward till about opposite front margin of orbit. Rakers fine, slender, longer than filaments. Filaments and pseudobranchiæ about equally well developed. Isthmus trenchant in front, and flattened rather broadly posteriorly.

Scales cycloid, caducous or but few remaining on alcoholic examples and those mostly comprising dorsal and anal sheaths, and on base of caudal. A patch of adipose tissue on shoulder behind opercle above.



Origin of dorsal nearly midway between tip of snout and base of caudal and first developed ray longest. Anal low, inserted a little behind tip of depressed dorsal or a little nearer origin of ventral than base of caudal. Caudal forked and lobes pointed. Pectoral low, inner rays of each fin approximating and reaching about half way to ventral. Ventral inserted a little behind origin of dorsal or a little nearer base of caudal than tip of snout and reaching about  $\frac{2}{3}$  of distance to anal. Vent close in front of origin of anal.

Color in alcohol faded pale brownish, a little darker on back, and lower surface paler. Head more or less silvery, top brownish. Fins all pale or whitish, dorsal and caudal a little grayish. Median line of back with a dusky streak. Along course of what would be lateral line posteriorly a brownish streak. Iris silvery, a little slaty above.

Length  $1\frac{1}{4}$  inches.

Hailer's Rock. Altogether 17 examples were taken associated with the large schools of Anchovies seen about the tide pools. In life they are colored transparent or translucent greenish similar to the Anchovies. One example contained a crustacean parasite within the gill-opening, the long spiral egg-cases well protruding.

#### OLUPEIDÆ.

17. *Harengula sardina* (Poey). Fig. 2.

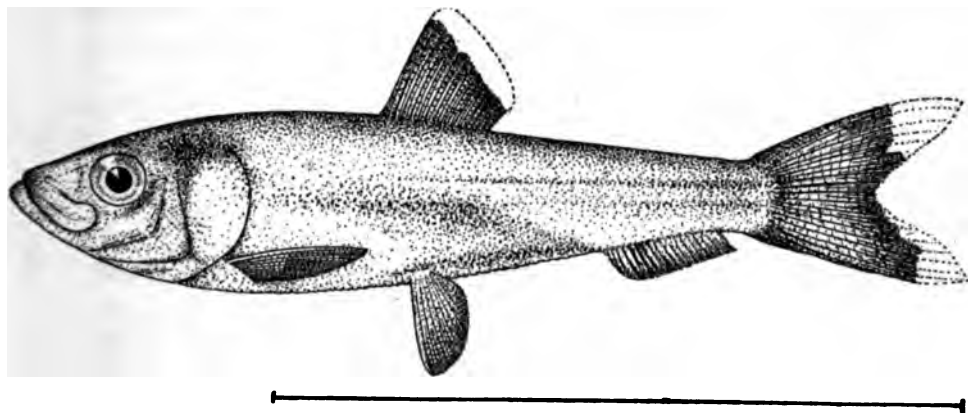


Fig. 2. *Harengula sardina* (Poey).

Two small examples taken at Hailer's Rock.

8. *Harengula humeralis* (Valenciennes). Shiner. Fig. 3.

Color in life bright or glistening silvery-white on sides and lower surface of body. Back bluish-green. Snout brownish. Eye silvery,

upper margin brownish blue-green. Dorsal and caudal gray-brown, other fins transparent whitish.

In the shallows of the Marquesas 30 examples were seined, associated with the Anchovies and other small fishes. In a tide-pool on

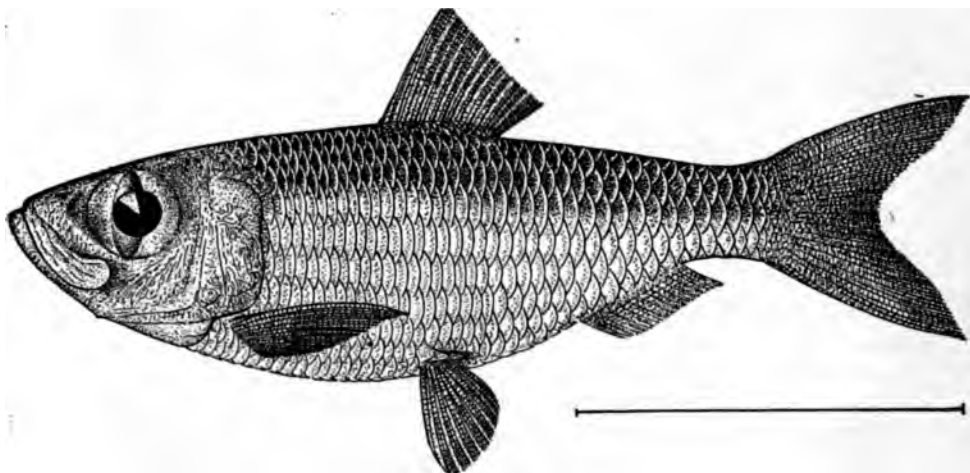


Fig. 3. *Harengula humeralis* (Valenciennes).

Hailer's Rock 2 were also taken. After being in alcohol some time most of the examples have the peritoneum showing plainly through the body-wall.

19. *Clupanodon oolina* (Linnaeus).<sup>1</sup> Thread Herring.

Occasional. No examples taken.

#### ENGRAULIDIDÆ.

20. *Anchovia brownii* (Gmelin). Sardine.

Color in life, above clear transparent hyaline-greenish washed with

<sup>1</sup> Drs. Jordan and Gilbert, in *Proc. U. S. Nat. Mus.*, V, 1882 (1883), p. 574, have restricted Lacépède's genus *Clupanodon* to *jussieu*. Later Drs. Jordan and Evermann, in *Bull. U. S. Nat. Mus.*, No. 47, I, 1896, p. 422, apparently consider *pilchardus* as typical. These precepts do not fall within the rule of elimination as the last name for which a generic name is proposed, so far as I can find, is *thrissa*. For this Dr. Gill proposed *Opisthonema*. At any rate *Sardinia* cannot be so considered as it is a synonym of *Thrissa* Rafinesque. Lacépède's species *thrissa* may be considered restricted to the American Thread Herring, as the Chinese fish included under Osbeck's reference is one of the *Dorosomatidæ*. *Opisthonema* Gill is thus to be superseded by *Clupanodon* Lacépède. The True Sardines, formerly placed under the latter name, will stand as species of *Thrissa* Rafinesque, with *Clupea pilchardus* Linnaeus as the type. Messrs. Jordan and Seal have pertinent remarks in *Proc. U. S. Nat. Mus.*, XXVIII, 1905 p. 771.

bright silvery, and sides and lower regions of the brightest silvery. Fins pale and more or less transparent. Iris silvery.

Reaches a length of 3 inches. Found throughout the Keys, the above notes from examples from Hailer's Rock. Very large schools were seen both in this locality and about the Marquesas. They swim in large shoals associated with the other small fishes, haunting the shallower as well as the deeper places along shore. They were unusually numerous about the broken rocky shores, where free ingress and egress could be had with the outer waters. Here the schools were seen more or less quiescent and with their heads all directed one way, so that upon any disturbance the whole mass would move more or less as if by one impulse. They appear mostly transparent in the water. I found them occasionally in the surf, where they were probably more abundant than I was able to determine. When taken from the water they soon die. I never observed them in any tide-pools which were cut off from the sea during low tide.

21. *Anchovia chærostoma cayorum* subsp. nov. Fig. 4.

Head  $3\frac{1}{2}$ ; depth 5; D. III, 9; A. III, 25; P. I, 12; V. I, 6; scales 36 (squamation injured) in a lateral series to base of caudal with several

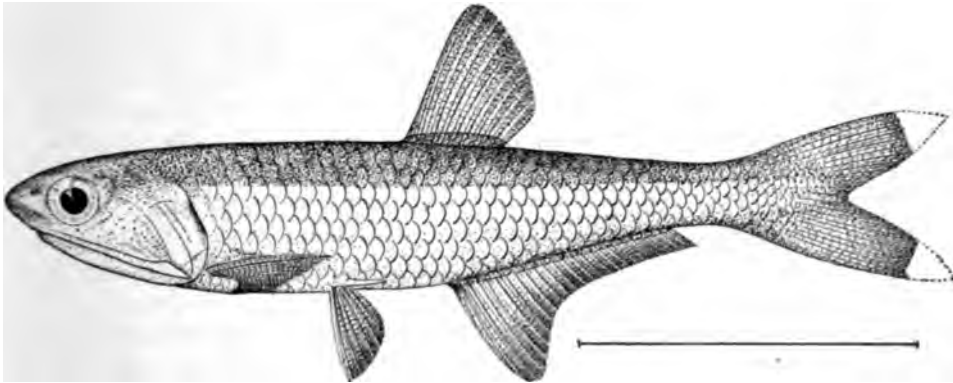


Fig. 4. *Anchovia chærostoma cayorum* Fowler.

more on latter; about 8 series of transverse scales from above origin of anal; width of head  $2\frac{1}{2}$  in its length; depth of head  $1\frac{1}{2}$ ; snout 5; eye  $3\frac{1}{2}$ ; interorbital space  $3\frac{1}{2}$ ; maxillary  $1\frac{1}{2}$ ; length of depressed dorsal  $1\frac{1}{2}$ ; caudal  $1\frac{1}{2}$ ; pectoral  $1\frac{1}{2}$ ; ventral  $2\frac{1}{2}$ ; base of anal  $3\frac{1}{2}$  in head and trunk.

Body strongly compressed, elongate in form, rather slender, and lower profile a little more convex than upper, edges not trenchant though rounded, and greatest depth about origin of dorsal. Caudal

peduncle strongly compressed, rather deep, and least depth about  $\frac{3}{4}$  its length.

Head strongly compressed, rather deep, and profiles more or less similarly convex. Snout rather blunt, rounded, convex, and upper profile pronouncedly convex. Eye circular, rather large and well anterior. Adipose tissue developed. Mouth a little inclined and gape extending nearly  $\frac{3}{4}$  length of head. Maxillary slender, long, and furnished with a single series of fine or minute teeth to its distal extremity which reaches almost to gill-opening in front of origin of pectoral. A similar series, though very minute, along margin of mandible. Vomerine teeth a little larger than those on palatines which are very small and uniserial. Also a still smaller series on each pterygoid. Symphysis of mandible reaching about opposite posterior nostril. Tongue small, little free, rounded, reaching forward till a little in front of anterior orbital rim and with a free asperous patch above. Nostrils close together, superior and a little nearer front rim of orbit than tip of snout. Interorbital space with a slightly elevated median ridge so that it is a little convex. Opercle and top of head posteriorly with varied shallow flutings. Cheek with shallow perforations, and some above eye posteriorly.

Gill-opening extending forward till opposite front rim of pupil. Rakers about 14+20?, slender, long, and longest much longer than filaments. Pseudobranchiæ smaller than filaments. Isthmus rather broadly rounded though compressed above. Shoulder-girdle notched once on each side below for reception of interopercle, and above behind opercle an adipose-like tract.

Scales cycloid, large, and caducous. Dorsal and anal with scaly basal sheaths. Scales on base of caudal rather small. Pointed axillary flap at base of pectoral  $\frac{3}{4}$  length of fin and inner rays of each fin approximated. A similar ventral flap.

Origin of dorsal nearer base of caudal than tip of snout and first branched ray longest. Anal inserted about opposite first fourth in length of depressed dorsal or much nearer origin of pectoral than base of caudal, and its anterior rays elevated. Caudal forked and lobes pointed. Pectoral low and reaching origin of ventral. Tip of depressed ventral reaching at least opposite origin of dorsal. Vent close in front of anal.

Color in alcohol pale brownish, paler or whitish below. Back with edge of each scale sprinkled with a series of brownish dots. A double series of brownish dots down middle of back. Top of head, snout, and opercle brownish with darker brownish dots. Upper posterior portion

of head with gill-opening showing through dark. Head otherwise bright silvery. Iris silvery. A broad brownish band overlaid with silvery and nearly as wide as pupil extends from above gill-opening to middle of base of caudal. It is broader in middle than at either end. A series of brownish spots along base of anal. Dorsal and caudal pale grayish marked with numerous pale brownish dots, other fins whitish.

Color in life with body more or less silvered and back above with a translucent appearance.

Length  $2\frac{1}{4}$  inches.

Type No. 30,613, A. N. S. P. Hailer's Rock, Florida Keys. June, 1904. H. W. Fowler. Also Nos. 30,614 to 30,620, A. N. S. P., paratypes with same data.

Found only at the above locality in company with *A. brownii*. Only these few were secured among the multitudes of the latter. From *A. charostoma* (Goode), with which this form may prove identical, it appears at present to differ a little, upon comparison with Porto Rican material, in the more elongate form, larger eye and head, and more blunt or rounded snout. Young examples have a smaller eye, nearly 4 in head.

(*Cayo*, in Spanish meaning a ridge of small rocks or islands in the sea, like those off southern Florida.)

#### SYNODONTIDÆ.

##### 22. *Synodus fæstens* (Linnaeus). Lizard Fish.

Color in life clear pale brownish above with about 10 wampum-like blotches of darker brown. In some examples this produces a pepper and salt appearance. A slightly dark double series of blackish dots across each blotch on back. On side just below back a series of zig-zag W-shaped markings also of same darker color. Same color accents end of each blotch in form of a trifle darker speck. A somewhat diamond-like blotch or ring between each median lateral marking and somewhat connected. Another blotch alternately below each of these, and still lower more paler tints of diffuse markings. A deep brown blotch at base of tail and another of pale brown at base of each lobe. Head brownish above, and variegated with deeper spots and more or less olivaceous-golden on sides above. Jaws and mandible variegated with olivaceous-brown. Iris golden-olive, in some lights pure golden, pupil dark green. Region of isthmus dull citron. Tints of colors on sides all more or less golden. Dorsal and caudal variegated

with golden-brown tints, otherwise pale grayish. Other fins dull whitish. Length about 3 inches.

A number of small examples were taken in the sandy shallows of the Marquesas.

#### MURÆNIDÆ.

23. *Gymnothorax funebris* (Ranzani). Moray.

Large examples were seen about the reefs off Snipe Key, lurking in the crevices and holes of the coral rocks. They were deep olive in color.

#### SILURIDÆ.

24. *Galeichthys felis* (Linnaeus). Cat Fish. Salt Water Cat.

Very abundant and a very foul feeder, eating any refuse or filth thrown overboard. They were so ravenous that it was possible to catch them on any kind of bait even on a bent pin. At times great quantities were said to have been taken in seines, in which cases the fishermen would cut the leads and floats, leaving the whole mass to extricate themselves as best they may. Their spines are very much dreaded by the fishermen, who claim they are able to produce dangerous and ugly wounds. Most all the examples I observed were about Big Pine Key.

#### PÆCILIIDÆ.

25. *Fundulus similis* (Baird and Girard). Sac-A-Latt.

Color in life with a whitish lateral band from opercle above to base of caudal interrupting slaty vertical bars which were 9 in number. Lower surface of body white. Dorsal, anal and caudal grayish, former with a well-defined pale base. An olive shade on opercle. Iris silvery, a little brownish above and below, and latter also with a little pale orange. Jaws pale. Length  $3\frac{3}{4}$  inches.

Only four examples obtained in the shallow pools on Boca Chica Key. The larger ones have as many as sixteen dark vertical bars. Found associated with this species were all of the following *Pæciliidæ*

26. *Cyprinodon variegatus riverendi* (Poey).

Three examples from the Marquesas and Boca Chica Key.

27. *Cyprinodon mydrus* Goode and Bean. Puss Gut. Fig. 5 (male).

Color in life nearly milky-white, upper surface or back above slightly brownish. Lower surface or body milky-white and fins very pale brownish. After death some examples turned pale olive on back and top of head, and on dorsal and caudal. These fins, back and side

speckled with golden-brown or coppery in the males. Lines of a similar shade on side of head, one across chin, one on preorbital, another from corner of mouth to lower rim of eye, and two others below and parallel up over opercle. Iris golden-brownish. Side of body with indistinct traces of several pale slaty vertical streaks. Lower fins very pale brownish-golden. Ventral and anal with a more or less regular series of golden spots, less distinct on latter. Females

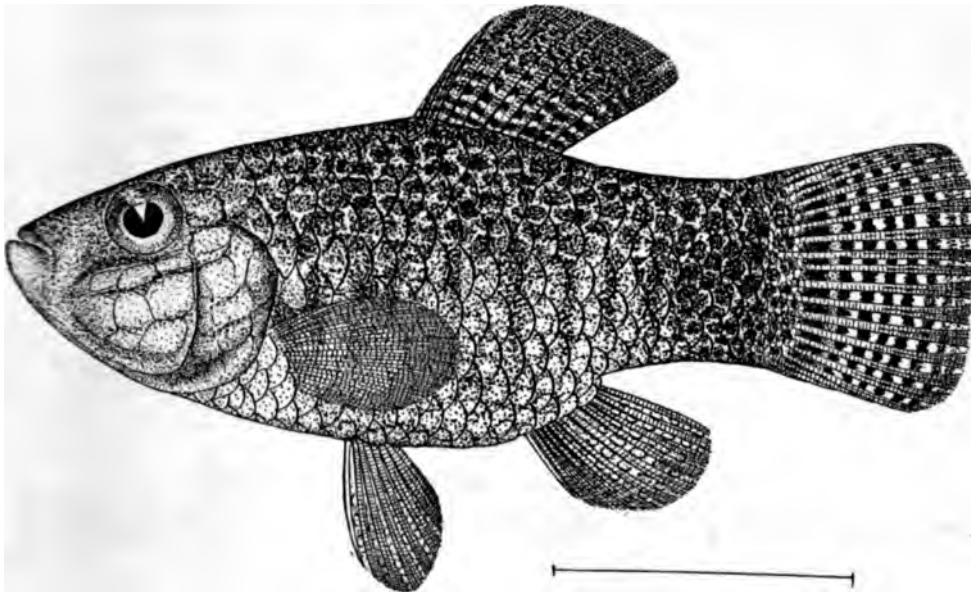


Fig. 5. *Cyprinodon mydrus* Goode and Bean.

were paler and had no spots on dorsal and caudal, and those on body more yellowish. In spirits young examples show large blotches of grayish on side and lack brilliant colors of the adults noted above. They were more or less milky-white in life.

This species is very abundant in pools and shallows of the Keys. They were met with in great numbers all about the Marquesas, and in the pools on Boca Chica Key. Young were abundant in the tide-pools on West Cudjoe's Key. Great numbers were also found about Big Pine Key.

*Cyprinodon carpio* Günther<sup>2</sup> may be identical, but the indefinite locality "America" admits a doubt. The figure given by Drs. Jordan

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<sup>2</sup> *Cat. Fish. Brit. Mus.*, VI, 1866, p. 306.

and Evermann<sup>3</sup> differs in that there are five rows of scales on the cheek.

28. *Mollienia latipinna* Le Sueur. Mud Fish.

Color in life brown. Side of head with gray and same color on costal region. Iris brown. Lower surface of body white. Dorsal and caudal with grayish-brown spots and other markings of brown, blackish-brown and dull amber-color. Some examples with caudal dull amber in middle basally and a lower series of longitudinal lines of dots of pale amber. Ventral and anal white.

This species was found to be very abundant in the pools on Boca Chica Key, associated with other small fishes. Many are males with the dorsal fin enlarged and the edge of the caudal blackish.

MASTACOEMLIDÆ.

29. *Tylosurus notatus* (Poey). Gar. Fig. 6.

Color in life clear hyaline-green overshot with silvery. Greenish about edge of opercle. Iris silvery. A narrow greenish line from origin of pectoral above to base of caudal. Vertical fins pale greenish-brown, tinted slightly with ruddy.

Boca Grande, Big Pine and Boca Chica Keys, also Hailer's Rock and the Marquesas.

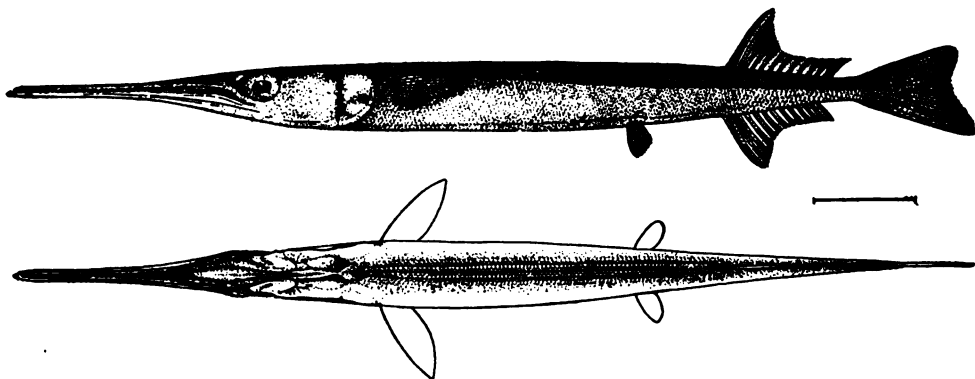


Fig. 6 *Tylosurus notatus* (Poey).

Found in small pools on some of the Keys. They usually associate in small schools in the shallows or near the shore. When in the water their bodies have a transparent appearance and in some lights are difficult to distinguish. They are also fond of lurking about overhanging mangroves.

<sup>3</sup> *Bull. U. S. Nat. Mus.*, No. 47, IV, 1900, Pl. 112, fig. 297.



**HEMIRAMPHIDÆ.****30. *Chriodorus atherinoides* Goode and Bean. Hard Head.**

Color in life bright silvery. A narrow bright silvery-white line from gill-opening to base of caudal. Upper surface of body and back pale translucent brownish, each scale with a small patch of dark dots forming longitudinal series and about three above lateral line. Down middle of back three narrow lines of same color, median one pale or less distinct than others, and all close together. Dorsal and caudal pale grayish-brown and other fins translucent whitish. Iris silvery-white. Length  $4\frac{1}{2}$  inches. Alcoholic examples show lateral silvery band slaty.

Found associated with *Atherina laticeps* in the sandy shallows of the Marquesas and about Hailer's Rock.

**31. *Hemiramphus brasiliensis* (Linnaeus). Balaó.**

Reported as frequently seen.

**ATHERINIDÆ.****32. *Atherina laticeps* Poey. Silver Sides.**

Very abundant. Large schools were seen about the Marquesas, Boca Chica and Snipe Keys.

**MUGILIDÆ.****33. *Mugil curema* Valenciennes. Mullet.**

Abundant in the shallows near the shore where they associate in large schools. When disturbed they rush away, causing a loud noise in the water. Many were taken in cast-nets by fishermen, as many as a dozen at one time. They average several pounds each, and I found their flesh excellent eating. All examined appeared to be this species. They were most abundant in the Marquesas shallows.

**34. *Mugil trichodon* Poey. Fig. 7.**

Head  $3\frac{1}{10}$ ; depth  $3\frac{1}{4}$ ; D. IV-I, 8; A. III, 8; scales about 36 to base of caudal in a lateral series; about 12 series of scales between origin of spinous dorsal and middle of belly; 19 scales before spinous dorsal; snout  $3\frac{1}{2}$  in head; eye 4; interorbital space  $2\frac{1}{2}$ ; pectoral  $1\frac{3}{4}$ ; ventral  $1\frac{1}{4}$ . Teeth large, conspicuous, uniserial, ciliform, and a little larger in upper jaw. Pectoral not quite reaching opposite origin of spinous dorsal.

Color in life with back bluish-slaty. Side and lower surface silvery-white. Base and axil of pectoral dark slaty. Dorsal, caudal and

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<sup>4</sup> A number of Flying Fish, *Exocoetidae*, were seen off Big Pine Key. They were all small.

anal pale brownish. Side of head with slight golden reflections. Iris brownish, a silver margin close to pupil.

Length of largest example  $2\frac{1}{2}$  inches, and though only three were taken with other small fishes, many others were seen. They frequent the shallows like *M. curema*, but so far as I could observe never associate. Marquesas Keys.

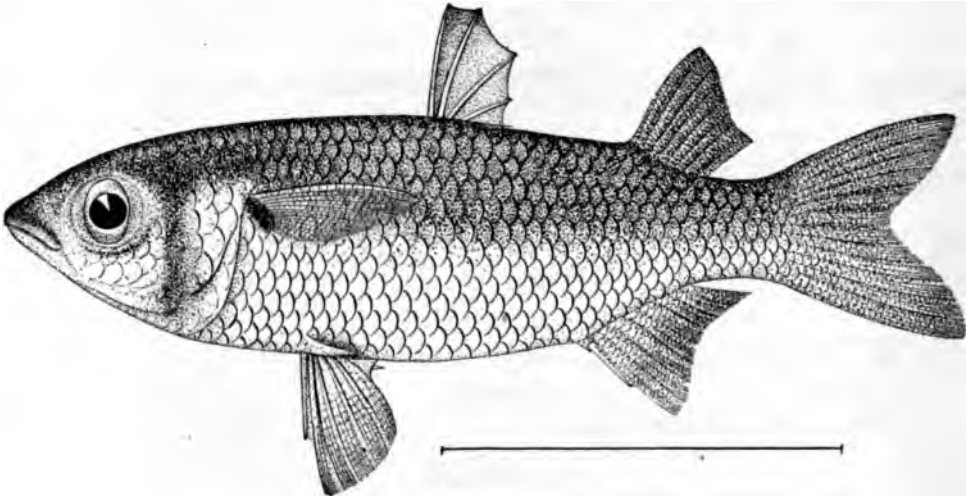


Fig. 7. *Mugil trichodon* Poey.

#### SPHYRÆNIDÆ.

35. *Sphyræna barracuda* (Walbaum). Barracuda.

Color in life more or less silvery. Above pale brownish with about six pairs of deep olivaceous double saddles meeting as many pairs of rounded blotches on side of body just above or over lateral line. A similar colored bar from end of snout to eye continued behind and across opercle. Iris pale olivaceous, slightly orange around pupil. Dorsals and caudal slightly grayish or a trifle dusky marginally, other fins pale whitish. These were all young examples. In the smallest, which are a little over an inch long, saddles of back are separated from lateral blotches by a pale or translucent brownish area. Dorsal and caudal but little darker than other fins. A brownish-olive spot at base of caudal in all stages of young.

Many examples obtained at the Marquesas and Boca Chica Key, largest about  $3\frac{1}{2}$  inches. An adult, several feet long, was harpooned off Channel Key, and a number of large examples were noted off Bahia Honda Key.

SYNGNATHIDÆ.<sup>5</sup>36. *Syngnathus mackayi* (Swain and Meek). Pipe Fish. Fig. 8.

Color in alcohol brownish marked with small whitish dots or spots, each ring with a pale or whitish blotch on each keel, usually small and on side at intervals of four rings extending down in form of narrow bars. Back grayish with pale brown vermiculations medianly. On



Fig. 8. *Syngnathus mackayi* (Swain and Meek).

lower surface of tail small white spots producing a more or less confluent appearance. Head brownish, mottled grayish above, and snout and under surface with more or less whitish spots. Dorsal pale brownish-white mottled with pale brown. Caudal similar, only blotched and darker. Pectoral pale transparent brownish-white. Iris pale slaty.

Color in life resembling the following species. Back whitish, finely vermiculated or specked with lavender, brownish and olivaceous. Lower surface a little more green than sides which are marked with bluish-green. Snout slightly brownish. Iris pearl-colored with brownish. Length  $6\frac{1}{4}$  inches.

Marquesas and Big Pine Key. This species is subject to color variation, some examples inclining more to green and others to brown than the one noted above.

37. *Syngnathus elucens* Poey. Pipe Fish. Fig. 9.

Color in alcohol brownish, each ring with a blotch of whitish posteriorly on each keel, those on sides of about every fifth ring producing about a dozen vertical lateral bands. Whitish blotches on lower surface of caudal becoming more or less confluent posteriorly. Head brownish, snout with a few white spots and under surface with a number of whitish blotches. Dorsal, caudal and pectoral whitish, former fins with brownish specks. Iris dull slaty.

Color in life with back whitish finely specked or dotted with lavender, brownish and olive medianly. Lower surface more clearly green than

<sup>5</sup> I follow Profs. Jordan and Snyder in retaining *Syngnathus* for the species formerly called *Siphostoma*. Of the four species available by elimination, viz., *typhle*, *acus*, *pelagicus* and *ophidion*, the second (*acus*) remains and therefore must be regarded as the type. It is congeneric with *Siphostoma* Rafinesque. For *typhle* Rafinesque also proposed *Typhle*, and for *ophidion*, *Nerophis*. The latter name must therefore be used for the Ocean Pipe Fishes.

sides and each ring marked by a whitish or light vertical line. Some examples are darker, others have more white or brown, and still others are marked below with very pronounced white spots below, with general color of body pale greenish-brown and tail paler. Fins transparent, dorsal and caudal marked with brownish. Iris pearl-colored with brownish spots. Length  $4\frac{1}{2}$  inches.



Fig. 9. *Syngnathus elucens* Poey.

A number of examples from the Marquesas, taken with many small fishes found in the sea-weed and marine vegetation of the shallows. One also from Big Pine Key.

38. *Syngnathus louisianæ* Günther. Pipe Fish. Fig. 10.

Color in alcohol rather pale brown, upper side of back dark brown and middle of back much paler. Several series of brown wavy longitudinal lines more or less irregular, but parallel, on middle of back and caudal above. Along side, just below each keel, a short brown horizontal line on each ring. In dark color of upper half of side several others appear on some rings. On lower half of side brown lines are sometimes more or less convex, and on caudal they assume various vermiculate patterns. Lower or under surface of both head and body dull or pale brownish-white without markings. Head brownish, pale above, and on side of snout a dark brownish streak through eye and back across opercle above, giving rise on side of body to hori-



Fig. 10. *Syngnathus louisianæ* Günther.

zontal dark line on each scute just below uppermost keel. Dorsal, caudal and pectoral pale brownish-white, caudal with some darker or brownish markings. Iris pale slaty, except brownish streak, and grayish below.

Color in life similar. Back grayish-white above or medianly with brown lines. Upper side olivaceous-brown. Lower surface pale whitish, lines on lower side brownish, and under surface of abdomen

pale greenish. Dorsal whitish with very pale lines, other fins more or less transparent. Iris shell-color with a brown horizontal cross-bar. Length 10½ inches.

The Marquesas and Big Pine Key. This is the largest and strongest species met with. It was found associated with the others in the sea-weed. It varies in color when seen in life. One example now in alcohol is dark blackish-brown on upper half of side. A young example taken later at Hailer's Rock has about sixteen dark annulations.

**39. *Hippocampus punctulatus* Gulchenot. Sea Horse.**

Color in life deep dull olivaceous, tubercles or joints pale at bases and ruddy at tips. Body everywhere more or less variegated with narrow whitish vermiculating lines, and those about eye radiating from pupil, which is blackish. Pectoral and dorsal pale grayish, latter finely spotted at base with small dusky or olive specks.

Sea-weed of the Marquesas.

**40. *Hippocampus zosterae* Jordan and Gilbert. Sea Horse.**

One living example was pale brownish-white, side speckled with pale yellowish. A submarginal dorsal line of blackish. Marginal portion of belly dusky-olive. Rings white. Pupil blackish.

Another was a little more brownish. Dorsal margined with pale orange, and a submarginal black band. Brown lines radiating from eye and on side of head slightly variegated with pale olive.

Another was a little more highly colored and more of a golden hue. Rings at intervals more grayish-white. Coronet with a dusky filament.

One had a whitish snout. General color more brownish. Brownish lines, edged with white, radiate from eye. Tubercles on trunk and caudal rings at intervals more whitish.

An example was similar to pale brownish-white one, but with minute specks. A pale brownish line from eye to end of snout. Whitish caudal rings at intervals, and like most of preceding with a more or less evident submarginal dusky line on dorsal, fins otherwise plain and pale-colored.

One with pronounced tubercles all more or less pure white, interspaces on rings pale olive, those on ventral surface darker, and all more or less variegated with whitish dots. Whitish lines radiate from eye. Dorsal with a submarginal brownish band, fins otherwise pale whitish. Rings on caudal white and pronounced at intervals. Brown band from eye to tip of snout crossed by several whitish fasciæ.

Another less tuberculate, more brownish, and variegated with white and pale brown.

Darker examples were almost blackish, without vermiculating lines. Side somewhat brownish. Snout whitish. Dorsal and caudal plain-colored. Other examples were more variable.

Many others were noted, some olivaceous, brownish, coral-white, or almost entirely white, and others pale lavender.

From the above notes it is easily seen that this species is subject to great color variation in life. Some examples are much more brilliant than others. There is also variation in the tubercles. All my examples collected in the sea-weed (*Zostera*) of the Marquesas shallows.

#### SCOMBRIDÆ.

41. *Scomberomorus cavalla* (Cuvier). King Fish.

Abundant.

#### TRICHIURIDÆ.

42. *Trichiurus lepturus* Linnaeus.

Sometimes taken.

#### ISTIOPHORIDÆ.

43. *Istiophorus nigriscans* (Lacépède). Sail Fish.

Almost every season a large example is reported from these Keys.

#### CARANGIDÆ.

44. *Trachinotus falcatus* (Linnaeus). Pampano.

Color of young in life, dusky-lavender. A diffuse vertical patch of brownish dots on side from middle of dorsal to anal. Dorsal and anal more or less sprinkled blackish, former otherwise with whitish and latter with pale orange adjoining blackish of anal. Margin of anal and entire caudal white. Caudal peduncle white. Spinous anal red, spotted with black. Breast rosy, with brownish specks. Top of head brown. Jaws and lower surface of head whitish. Cheek specked with brown. Iris red, with brownish margin. One  $1\frac{3}{8}$  inches long, from the Marquesas.

#### SERRANIDÆ.

45. *Petrometopon oruentatus* (Lacépède). Red Hind.

No examples were seen, but it is reported from the Marquesas and other places.

46. *Epinephelus striatus* (Bloch). Nassau Grouper.

Marquesas Islands. Seen in the fish-pots.

**47. *Epinephelus maculosus* (Valenciennes).**

Reported.

**48. *Epinephelus drummond-hayi* Goode and Bean. Speckled Hind.**

Reported from about the Marquesas.

**49. *Epinephelus morio* (Valenciennes). Red Grouper.**

Color in life olivaceous-brown, branchiostegal region and cavities of jaws salmon-color. A brown streak opposite upper margin of maxillary in preorbital depression. Inside of pharynx vermilion, and inside of mouth fleshy-pink. Fins, except pectoral, dusky or blackish, especially submarginally. Narrow margins of rayed vertical fins whitish. Pectoral golden-brown, most noticeable marginally. Base of ventral pale whitish. Trunk marked with pale diffuse or indistinct scattered pale spots. A few dots about size of pin-head on preorbital. A salmon-pink line on base of anal. Iris golden or brassy-brown. Two examples from Bahia Honda Key.

About the Marquesas I saw a number of these fishes in fish-pots and in live-boxes. At Snipe Key they were frequently seen about the reefs.

**50. *Promirops guttatus* (Linnaeus). Jew Fish.**

One taken in a pool on Boca Chica Key, and a large one off West Cudjoe's Key. They were reported as not at all uncommon about the other Keys. Several were also seen in the reef near Snipe Key.

### LUTIANIDÆ.

**51. *Lutianus griseus* (Linnaeus). Mangrove Snapper.**

Marquesas and Boca Grande Key. Found about the roots and usually under overhanging mangroves, from which places they dart or swim quickly out to the open water when disturbed. They associate with the other snappers, and in some places are very abundant. Some attain quite a large size.

**52. *Lutianus apodus* (Walbaum). Schoolmaster.**

A very young example in alcohol which I take to be this species has the body dark brownish with about six pairs of dark transverse bands, the paler spaces between each much narrower alternately. Vertical fins more or less pale or whitish, spinous portions blackish basally. Pectoral and ventral dusky. A brownish streak from tip of snout to eye and then continued posteriorly along upper side of head to gill-opening above. Iris slaty. Eye about three in head. Preopercle with a short spine at lower posterior corner. Length one inch. Marquesas Islands.

Other examples were found at Big Pine Key.

**53. *Lutianus aya* (Bloch).** Red Snapper.

Reported from the Marquesas, but no examples taken.

**54. *Lutianus synagris* (Linnaeus).**

Marquesas Islands.

**55. *Ocyrops chrysurus* (Bloch).** Yellow Tail.

Color in life purplish-brown above, side rosy-purplish, becoming more purplish below. Jaws rosy. Iris brassy-white, and a red bar behind pupil. A gilt-green streak from tip of snout to caudal, broadening behind and including upper half of caudal peduncle and finally including all of tail. Edge of tail narrowly dull red-orange. A number of large gilt-green blotches above lateral streak. Narrow pale longitudinal gilt lines, lower ones very pale, below lateral band. Dorsal gilt-green. Margin of soft dorsal and base of spinous fin dull diffuse plumbeous. Anal pale milky, medianly pale greenish-yellow. Pectoral dilute pinkish. Ventral milky, first ray dull greenish-yellow. Lower surface of body white. Inside of mouth and gill-opening white. Length 8 inches. Hailer's Rock.

One of the most abundant food-fishes, large numbers being in the markets of Key West during all of our visit. It has been reported from all the Keys by fishermen. Most of our examples were taken in the deeper channels, like some off Bahia Honda Key.

#### **HÆMULIDÆ.**

**56. *Hæmulon sciurus* (Shaw).** Grunt. Yellow Grunt. Fig. 11 (young).

Color in life sky-blue above, inclining or fading to plumbeous below. Lines on snout and upper back in front more or less violaceous. Inside of mouth bright scarlet. Iris silvery. Dorsal plumbeous gray-brown, rayed fin and caudal with slightly more plumbeous and latter becoming pale brownish marginally. Margins of dorsal dull amber, also same shade at base of spinous fin and about seven dull amber blotches basally on radii of second dorsal. Pectoral brownish-amber. Ventral and anal golden-amber, and streaks on side same. Axil of pectoral pale.

The figure represents a young example from the Marquesas.

Jew Fish and Bahia Honda Keys, and found very abundant throughout our trip.

**57. *Hæmulon plumieri* (Lacépède).** Grunt. Boar Grunt.

Color in life of young, all olivaceous above, more or less golden or gilded, especially laterally. Head with bright blue lines, on trunk



immediately becoming plumbeous and fading. Fins all more or less pale olive-brown, margin of spinous dorsal somewhat pinkish. Base of caudal with a blackish spot. Inside of lower jaw pale orange.

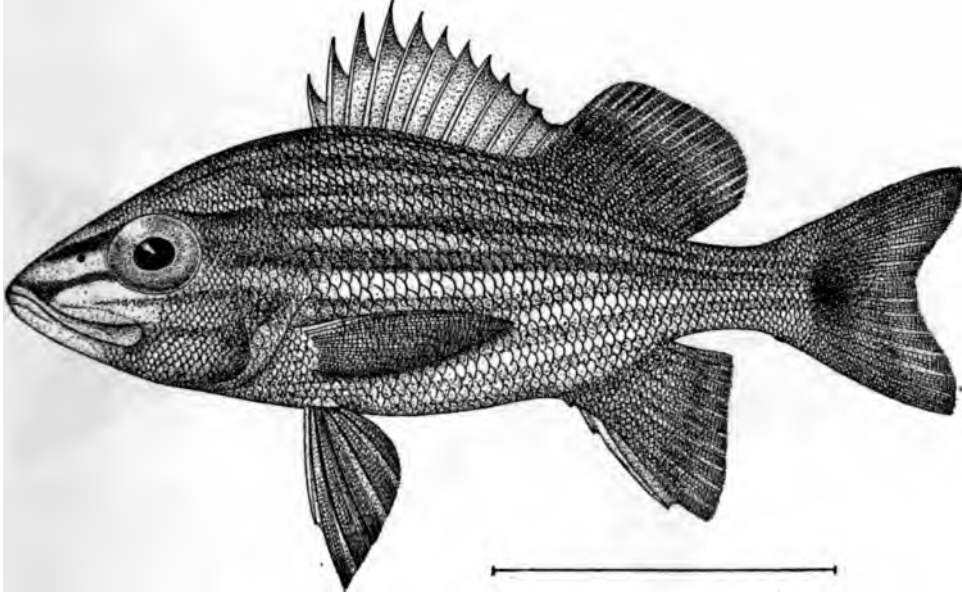


Fig. 11. *Hamulon sciurus* (Shaw).

Iris silvery tinted with pale orange above. Length  $2\frac{1}{2}$  inches. Another was similar except gilt bands were a little broader, upper surface of body a little more olivaceous, ventral and anal more golden, and mandible white.

Very abundant about the Marquesas where many were seined.

**58. *Bathystoma rimator*** (Jordan and Swain). Young Grunt.

Grassy Key, Hailer's Rock and the Marquesas. Very abundant in these localities, also about the reefs near Snipe Key, where large schools were seen swimming about in the quiet or still waters.

#### SPARIDÆ

**59. *Calamus penna*** (Valenciennes). Speckled Porgy. Fig. 12 (young).

Color in life brownish, pale purple above on back, and side and lower surface silvery. About six golden-olive vertical bands with edges of

each scale within more or less dusky. Markings extending on fins which are very pale brownish. Iris golden. Length  $3\frac{7}{8}$  inches.

The Marquesas and Boca Chica Key.

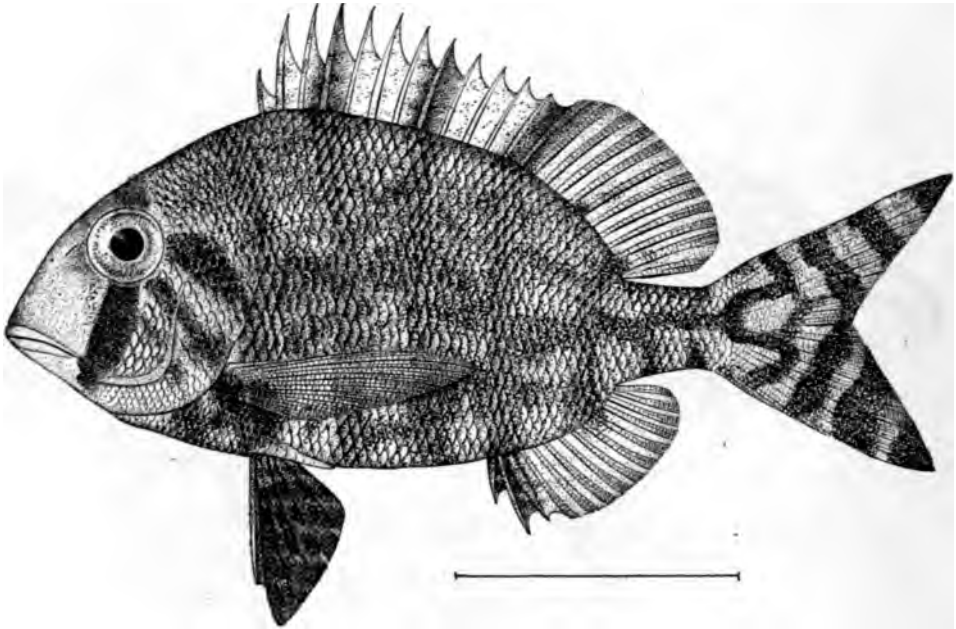


Fig. 12. *Calamus penna* (Valenciennes)

**60. *Lagodon rhomboides* (Linnaeus). Bream.**

Color in life pale bluish-olive above, below silvery white. Gilt lines above parallel with lateral line, and below horizontal. Vertical lines dusky slate-color, and forming a black blotch at beginning of lateral line. Dorsal spines gilded silvery slate-color. A median broad gilt band entire length of dorsal and anal. Edge of spinous dorsal gilt. Caudal brownish with golden tint. Pectoral and ventral whitish, latter with a gilt line in middle of its length. Inside of gill-opening silvery. Iris silvery with golden and brown. Length  $3\frac{3}{4}$  inches.

Marquesas, Grassy and Big Pine Keys, and Hailer's Rock.

**GERRIDÆ.**

**61. *Eucinostomus gula* (Valenciennes). Shad.**

Color in life bright silvery, back tinted with very pale gray-blue. About four indistinct grayish vertical bands on side of back, most

distinct in young examples. Dorsal and caudal grayish, other fins paler and translucent. Iris brownish with a brownish vertical bar.

The Marquesas, Boca Chica, West Cudjoe's and Grassy Keys, and Hailer's Rock.

#### POMACENTRIDÆ.

62. *Pomacentrus leucostictus* Müller and Troschel. Cock Eye Pilot.

Color in life with upper half of body anteriorly brilliant violet, this color changing insensibly into yellow, and becoming intense orange-yellow posteriorly as on caudal and on caudal peduncle. Spinous dorsal like back in front. Rayed dorsal yellowish like back posteriorly. A black blue-edged ocellus at junction of dorsals basally. Lower margin of anal olivaceous-yellow, rest of fin like abdomen. Pectoral and ventral orange. Three brilliant, or light, blue lines from eyes and snout to occiput. Iris brown.

Two small examples, a little less than an inch in length, were taken in the tide-pools off Hailer's Rock. When in the water they are very conspicuous on account of their brilliant coloration. They are not especially active swimmers though shy, the smaller ones usually escaping capture on account of their size. Found associated with *Blennius cristatus*, *Cyprinodon mydrus* and *Glyphisodon mauritii*.

63. *Glyphisodon mauritii* (Bloch). Sheepshead.

Color in life, back shaded with lemon-yellow. Five distinct vertical bars of deep plumbeous, edges of scales within each dusky-plumbeous. Lower surface of body chalky-white. Fins brownish and transverse bars extending on them. Scales on base of anal specked with dusky, otherwise plumbeous-white. Base of pectoral above, blackish. Each ray and spine of ventral pale dusky, axillary scale white. Head above plumbeous with a deep golden shade. Side of head plumbeous. Iris brown, front rim yellow. One example  $4\frac{1}{2}$  inches long from the Marquesas shallows.

A young example from Hailer's Rock was more greenish-yellow above in life. Below slaty-plumbeous, becoming more or less silvery on ventral region. Vertical bars dusky. Greenish-yellow and dark bars on spinous dorsal, other vertical fins pale-grayish. Pectoral and ventral whitish. Iris brown. Length  $1\frac{1}{4}$  inches.

#### SCARIDÆ.

64. *Cryptotomus beryllinus* Jordan and Swain. Parrot Fish.

Color in life brown, edges of some scales darker, those on lower surface of a light chestnut tint. Dorsal and anal slightly brownish, with

a ruddy tint and mottled with slightly darker spots. Caudal brownish with slightly brownish cross-bars. Pectoral and ventral pale brownish-white with slight cross-markings of a chestnut tint on latter. Eye silvery. Marquesas.

Another, from same locality, had ventral and anal more rosy-red. Small ones were speckled with dusky and tinted orange-purple on anal below. Spots on belly pale purple.

65. *Sparisoma flavesceus* (Schneider). Parrot Fish.

Marquesas, Big Pine and Boca Chica Keys.

66. *Pseudoscarus guacamaia* (Cuvier). Parrot Fish. Green Parrot Fish.

I saw a large example of this species swimming about the reef near Snipe Key. In the water it appeared to be entirely dark green.

#### CHÆTODONTIDÆ.

67. *Chætodon capistratus* Linnaeus. Butterfly Fish.

One example seen in the reef about Snipe Key. It was very evidently this species and measured about 5 inches in length, as far as I could judge.

68. *Pomacanthus arcuatus* (Linnaeus). Black Angel.

Color in life blackish. Bars bright lemon-yellow. Each scale on side with a black spot. Iris deep blackish-brown, marginally blackish. Length  $4\frac{5}{8}$  inches.

Only one example was taken about the roots of a red mangrove in the Marquesas shallows. It was also reported by several fishermen as rather common about the roots of overhanging mangroves of several Keys.

69. *Angelichthys ciliaris* (Linnaeus). Yellow Angel. Golden Angel. Blue Angel.

Several of these beautiful fishes were seen about the reefs near Snipe Key. They like the protection of large rocks and are exceedingly brilliant among their equally showy surroundings.

#### MONACANTHIDÆ.

70. *Stephanolepis hispidus* (Linnaeus). File Fish. Leather Fish.

Color in life green mottled with whitish and brown. Iris pale yellowish. Some examples with fine dusky dots and others with pubic flap edged with pale orange. Subject to great color variation, especially with respect to pattern.

Very abundant in the sea-wrack about the Marquesas. Also taken about Hailer's Rock.

**OSTRACIONTIDÆ.**

71. *Laetophrys trigonus* (Linnaeus). Trunk Fish. Shell Fish.

Color in life pale olive with blue spots or dots. Blotch of blackish on side. Fins pale yellowish-brown, caudal more brownish. Base of dorsal blackish. Iris pale yellowish. Length  $6\frac{1}{2}$  inches.

Marquesas Islands.

72. *Acanthostracion tricornis* (Linnaeus). Horned Trunk Fish.

Color in life with belly pale sulphury. Spots on body blackish-brown. Fins pale brownish, caudal with a few spots. Chin whitish. Iris yellowish-white with brown spots. Length  $3\frac{1}{4}$  inches.

Marquesas Islands.

**TETRODONTIDÆ.**

73. *Spheroides nephelus* Goode and Bean. Puffer. Swelling Fish.

Color in life with side of body citron-yellow. Back variegated with pale vermiculating blue lines of dots and marked with black spots. Blue lines also forming ocelli of black lateral blotches. Fins dilute brownish. Iris dilute yellowish. Length  $2\frac{1}{2}$  inches.

Marquesas Islands.

74. *Spheroides plumieri* (Schneider). Puffer. Swelling Fish.

Color in life brownish above tinted with pale olive and marbled with blackish-brown. Tentacles on back whitish. A dark expanded triangular blotch between eyes. Side of body olive, blotches blackish. Fins pale or dilute brownish. Caudal whitish, and basally and submarginally with a broad transverse blackish-brown bar. Lower surface of body chalky-white. Iris pale orange-yellow. Length  $3\frac{1}{2}$  inches.

Marquesas Islands and a number from Boca Chica Key.

**DIODONTIDÆ.**

75. *Diodon hystrix* Linnaeus. Porcupine Fish.

This, and sometimes the following, are taken and dried as curios. Nothing further than that both species occur was gathered from the fishermen.

76. *Diodon holocanthus* Linnaeus. Porcupine Fish.

77. *Lyosphæra gibbosa* Evermann and Kendall. Marble Fish.

Color in life pale olivaceous above. Black below forming reticulating lines with bright orange spots. Black lines reticulating above in olivaceous. Jaws pale brownish. Fins whitish. Iris pale golden. Length  $\frac{1}{4}$  inches.

This species was reported not at all uncommon in the shallows of the Marquesas about the *Zostera*, though I only found one example. It is a very curious and interesting little animal and I watched it inflate and collapse several times before death. The inflation was slight, much less than that of *Spheroides*. This specimen agrees best with the larger figure given by Drs. Evermann and Kendall,<sup>6</sup> though the dark reticulating lines are more distinct. Those on top of the head are narrow, or fine, and others are broken a little. Those all over abdomen are broader and darker.

#### SCORPÆNIDÆ.

78. *Scorpena grandicornis* Cuvier. Sculpin.

Color in life brownish variegated with darker and whitish. A broad brownish band from eye down over cheek. Eye brownish. Fins blackish-brown and whitish. Body marked most everywhere with small whitish spots. Length  $2\frac{9}{16}$  inches.

Two examples were seined in the sea-wrack of the Marquesas shallows.

#### GOBIIDÆ.

79. *Mapo seporator* (Valenciennes).

Color in life mottled brownish above, sides with darker brownish spots. Back also with dusky and olivaceous markings. Lower surface white. Margin of anal narrowly whitish. Ventral white. Other fins more or less grayish and transparent. Iris brownish. Length  $2\frac{7}{16}$  inches. Hailer's Rock, in a tide-pool. After being in alcohol there is an evident small bluish shoulder-spot.

Another example was brownish in life with a dull bluish tint, spots more dull or pale bluish. Markings on back brownish. Fins brownish, spots pale bluish. Outer portions of dorsal pale yellowish, basally spotted with pale bluish, and brownish between. Caudal same. Anal paler bluish than on dorsal, becoming somewhat dilute brownish-yellow distally with a submarginal brownish line, and tip of each ray whitish. Pupil greenish, edged narrowly with golden. One example 4 inches long from the sea-wrack of the Marquesas shallows.

#### PLEURONECTIDÆ.

80. *Platophrys ocellatus* (Agassiz). Flounder.

Color in life pale sandy-brown, mottled with white, deep brown and gray, white forming distinct spots. Fins also spotted with same

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<sup>6</sup> Bull. U. S. Fish. Comm., XVII, 1897 (1898), p. 131, Pl. 9, figs. 11 and 12. Rappahannock River, near the mouth of Windmill Creek, Virginia. (W. C. Kendall. Type No. 48,794, U. S. Nat. Mus.)

colors, dark brownish spots at regular intervals and showing through on dextral side, which is whitish. Iris pinkish.

A single small example from the Marquesas.

**BLENNIIDÆ.**

**CLININÆ.**

**CONGRAMMUS** gen. nov.

Type *Congrammus moorei* sp. nov.

Body elongate and tapering from head. Head deep, large and broadened posteriorly. Snout short. Eyes small, on top of head, directed upwards, close together, and near tip of snout. Mouth superior and much inclined. Lips with a series of large cutaneous flaps or cirri. Teeth in jaws in fine bands. No teeth on vomer or palatines. Interorbital space very narrow. No gill-rakers. No small upturned hook on shoulder-girdle. Scales rather large and cycloid. Lateral line continuous and arched till over pectoral. Dorsal not divided, radii similar or no apparent spines, and about 40 in number. Anal extending well forward on abdomen. Caudal free and rounded. Pectoral with tips of lower rays, and those of other fins, with exception of caudal, free. Color pale or brownish-white.

Small Blennies found in tropical waters or in shallows with sandy bottoms, and with something of the appearance of the Star Gazers or *Uranoscopidæ*.

(Κόγγρος, or Γόγγρος, *Congrus*, the ancient name of the Conger Eel; ἄμμος, sand.)

81. *Congrammus moorei* sp. nov. Sand Conger. Fig. 13.

Head  $3\frac{1}{2}$ ; depth of trunk at tip of pectoral 6; least depth of body 7; D. 41; A. III, 33; P. 14; V. I, 3; scales 46 in lateral line to base of

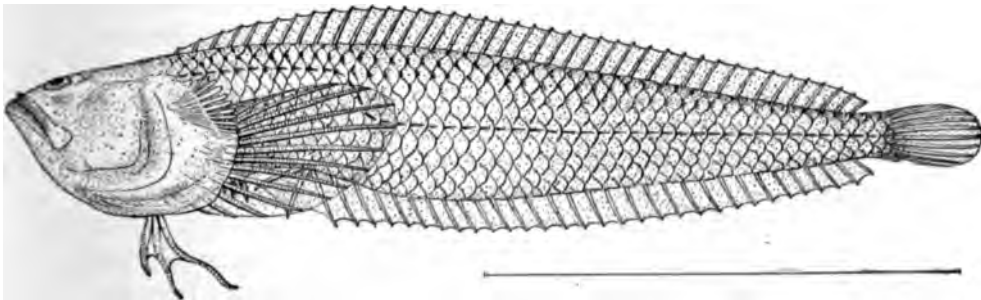


Fig. 13. *Congrammus moorei* Fowler.

caudal, and 1 more on latter; 5 scales obliquely between dorsal and lateral line at tip of pectoral, and 4 scales obliquely back and

down from same point to anal; width of head  $1\frac{2}{10}$  in its length; depth of head  $1\frac{1}{2}$ ; mandible  $2\frac{2}{5}$ ; caudal  $2\frac{1}{5}$ ; pectoral  $1\frac{2}{5}$ ; third ray of anal  $3\frac{1}{5}$ ; snout about 8 in head from tip of upper jaw; eye about  $7\frac{1}{2}$ ; inter-orbital space about half of eye.

Body elongate, swollen about branchial region in width but depth at this point less than farther back, and rest of trunk or long tail tapering. Upper profile convex, especially above pectoral posteriorly. Caudal peduncle compressed, and its depth nearly a fifth of length of head.

Head large, compressed anteriorly and swollen laterally posteriorly, and its greatest depth greater than that of trunk. Upper profile nearly straight, and but little inclined. Lower profile well inclined. Snout very short and a little broad. Eyes superior, directed upwards, close together near tip of snout and longer than broad. Mouth small, superior, and with jaws protruding. Mandible produced beyond upper jaw. Teeth in jaws, only apparent when mouth is open, fine and in bands. Apparently no teeth on vomer or on tongue. Each lip with a fringe of long cutaneous flaps of even length at regular intervals and conspicuous at all times. Tongue thick, rounded, a little posterior in mouth, and free in front. Nostrils directly in front of eye, separated, and anterior with a small cutaneous rim or in a short tube. Interorbital space very narrow and a little concave. Opercle with radiate striæ above, each of which is produced beyond posterior margin as a slender cutaneous process over gill-flap and beyond.

Gill-opening large, extending forward about midway in length of head. Rakers absent. Filaments small, about equal to orbital diameter. Isthmus compressed, and surmounted with broadened surface which is concave medianly.

Scales only on trunk, except several on base of caudal, where they are large. Scales cycloid, large, except on nuchal region anteriorly, and in parallel series. Lateral line of large simple tubes and continuous, at first high or after fourteenth scale of its course midway in depth of body.

Dorsal of simple flexible rays, none apparently evident as spines, tips of each free anteriorly, but becoming gradually more restricted by membranes posteriorly where it is free from caudal. Origin of dorsal beginning a trifle before posterior margin of preopercle. Anal with three rather pungent short spines, anteriorly separated from rest of fin, and nearly opposite origin of pectoral. Rest of anal, except first few elongated rays which are more or less erect with first two inclined forward and with well-developed membranes, similar to dorsal.



Caudal rounded and small, free from dorsal and anal. Pectoral large, broad, tips of lower rays free, and median rays longest. Ventrals jugular, each with three graduated rays with more or less free tips.

Color in alcohol pale brownish, whitish below, and a trifle darker on top of head. Latter, and back, with many minute pale brown specks or dots. Fins all transparent or brownish-white. Iris whitish, pupil slaty.

Color in life white, below brighter, above more translucent and marked on back alternately with pale brown and white. Fins transparent whitish, dorsal and caudal hardly darker. Iris pale greenish-white, becoming silvery marginally, and pupil black.

Length 2 inches.

Type No. 30,621, A. N. S. P. Hailer's Rock, Florida Keys. June 23, 1904. H. W. Fowler.

Only a single example, the type, was taken in very shallow water on the sandy shore of Hailer's Rock.

(Named for Mr. Clarence B. Moore, of Philadelphia, well known for his valuable researches in Archæology, and through whose interest in Zoology the expedition to the Florida Keys was realized.)

#### BLENNIINÆ.

##### **83. *Blennius cristatus* Linnaeus. Rock Fish.**

Color in life olive-brown above, saddles darker than ground-color. Body speckled or minutely spotted with deeper brown and whitish, markings becoming pale plumbeous below. Lines of dorsal brown. Edge of fins whitish. Caudal tinted a little with pale green. Abdomen dilute greenish-white and translucent. Fins all very pale transparent brownish, and pale markings dusky or whitish. Lower surface of head pale dusky. Eye brown. Crest on head dull deep red with dusky spots.

A larger example with dilute carmine tints to margins of dorsals and upper edge of caudal, posterior margin of latter and tips of dorsal radii whitish. A whitish-plumbeous spot at base of each anal ray and also at tip of each, submarginally dusky. Spots and lines on body dilute plumbeous or pearly-blue. Bars on caudal dusky. Occipital filaments reddish. Axil of pectoral dusky. Brownish bars on lower half of pectoral. Iris brown.

Small examples have brownish lines on dorsal more pale brownish.

Found very abundant in all the tide-pools on Hailer's Rock and West Cudjoe's Key. In such places they are often found completely entrapped, darting quickly about when disturbed, however, soon find-

ing shelter in the crevices. They are colored much in keeping with their surroundings, so that it is difficult to make out their presence when quiet.

**83. *Auchenopterus marmoratus* (Steindachner). Rock Fish.**

Color in life brown, darker markings dark brown. A pale spot on side of head tinted greenish-white. Pale markings on body whitish or pale brown. Caudal whitish. Blotches on dorsals and anals blackish-brown. Iris reddish. One small example from the seawrack in the Marquesas shallows.

**BROTULIDÆ.**

**84. *Ogilbia cayorum* Evermann and Kendall.**

Color in life nearly uniform or pale isabella-color, finely dusted with minute darker specks or dots. Eye slaty.

Four examples from West Cudjoe's Key were taken in the tide-pools. They all show a distinct opercular spine and have very inconspicuous or imbedded scales, not arranged transversely or otherwise in indistinct series, the fish having the appearance of being naked when alive.

**BATRACHIDÆ.**

**85. *Opsanus tau* (Linnaeus).**

Color in life brownish, below whitish. Dorsal and caudal pale brown, markings darker. Paler markings creamy. Iris brownish. One  $3\frac{3}{4}$  inches from the Marquesas.

Another,  $1\frac{1}{2}$  inches long, from West Cudjoe's Key has no ventral sucking-disk. Color-pattern suggesting that of certain Cottidæ. Blotches on body and vertical fins posteriorly very large and confluent, so that contrast between light and pale markings is pronounced. Belly and abdomen immaculate whitish.

**OGCOCEPHALIDÆ.**

**86. *Ogcocephalus radiatus* (Mitchill). Toad, Plate III.**

Color in life deep slaty-brown, without any distinct markings. Dorsal, caudal, anal and pectorals same color above and basally below, and marked with a beautiful network of whitish lines forming more or less distinct ocelli. Sides of trunk similarly colored. Lower distal portion of pectoral, ventral, anal and caudal tinged with golden. Under surface of body otherwise pale or soiled whitish. Iris brownish with pale radiating line. Length  $7\frac{1}{4}$  inches.

Big Pine and Ballast Keys, about the shallows. They do not move fast and are easily captured in the hand or in a small dip-net. They

lurk about the rocks or sea-wrack, and their protective colors make it difficult to distinguish them when quiet or not moving about.

## AMPHIBIANS.

### BUFONIDÆ.

**87. *Bufo queriens* Holbrook.**

In life plumbeous-gray, markings dusky slate-color. Lower surface of body translucent whitish. Soles of feet and toes brownish. Iris with yellowish next to pupil.

Abundant in the open grass-land on Big Pine Key. They progress by a series of short jumps.

### HYLIDÆ.

**88. *Hyla squirella* Daudin.**

In life plumbeous above speckled with dull brownish. A blackish-brown line from tip of snout along side of head and including eye in its course. Lower surface of body pale brownish-white. Legs pale translucent brown, whitish below and posterior feet dusky. Iris brown.

This species was found on the ground about shady hammock-land on Boca Chica Key. I also saw one on a Gumbo Limbo tree on Vaca Key.

**89. *Hyla carolinensis* (Pennant).**

A small green frog, evidently this species, was seen on Key West and Boca Chica Key.

## REPTILES.

### COLUBRIDÆ.

**90. *Natrix fasciata* (Linnæus). Moccasin.**

One example was taken in the mangroves of Boca Grande Key. Here they live in the pools among the roots and short sprouts, and are thus difficult to see on account of the seclusion afforded. I did not meet with it in any other locality, though it doubtless occurs as it was reported from No Name Key. The vernacular is "Moccasin," as distinguished from the "Cotton Mouth Moccasin" (*Agkistrodon contortrix*).

**91. *Bascanion constrictor* (Linnæus). Black Snake.**

Reported from No Name Key. Seen on Knight and Summerland Keys.

**92. *Lampropeltis deliatus* (Linnaeus). Red Snake.**

An example, reddish or coppery-red in color, was found on Boca Chica Key. Others were reported from No Name, Summerland and Cudjoe's Keys.

**OROTALIDÆ.****93. *Crotalus adamantus* Beauvois. Rattler. Rattle Snake. Diamond Rattle Snake.**

Reported from Boca Chica, Big Pine and No Name Keys. I observed it on Summerland and Sugar Loaf Keys, and on the latter one was secured.

**SCINOIDÆ.****94. *Eumeces fasciatus* (Linnaeus). Lizard.**

General color in life waxy-black. Lines on head and neck deep brick-orange, becoming rather more orange on trunk, and finally fading into deep ultramarine-violet tail, though latter at first azure. Line along side of head paler or more ochraceous. Lower surface of head pale or translucent, mandible somewhat dilute purplish and throat greenish. A tinge of pale brick-color on lower side of head. Iris brownish. Lower surface of trunk dusky with brassy reflections. Feet and legs black.

This beautiful little lizard was first noticed in the hammock-land on the east end of Boca Chica Key. They were also rather plentiful on Vaca Key, where a rather large one was secured.

**TEIIDÆ.****95. *Cnemidophorus sexlineatus* (Linnaeus). Lagarto. Lizard.**

In life upper surface brownish, and from above hind legs to tip of tail grayish-brown. Lower surface entirely chalky or livid dilute lavender-blue, inclining more to bluish laterally. A median pale streak from occiput along upper surface of tail to become joined with its fellows. They unite with a slightly ochraceous one on each side, though becoming pale gray on tail, and extending parallel from occiput. A bright yellow line similar in shape and course from above posterior margin of eye and extending back along side of tail where it also becomes gray. From lower eyelid below another of pale lemon to hip and fading out on femur. Still another, and paler, fading out on ribs in front. It is indistinctly defined. Eyelid pale yellowish. Iris brown. Lower side of head pale bluish. Top of head pale brown. Inside of mouth flesh-colored. Upper surfaces of fore legs grayish-brown. In sutures of squamation on posterior costal region, hind

legs, and front of tail, brick-colored patches. Lines fade out on tail which is almost entirely gray a short distance from its base. A brownish-gray line on posterior side of hind leg, leaving a white one between it and color above. It extends along lower side of tail where it is blue-green, and though continued a good distance back is not well defined. Toes and soles of feet pale brownish flesh-color.

Key West, Boca Chica, Big Pine, Knight, Vaca and Grassy Keys. The above notes are from an example from the former locality. They were abundant on most Keys, where they were seen running swiftly through the grass. They soon hide in holes or among rocks. About the lagoon on Key West I found them most common under low grassy vegetation where numerous insects, such as small grasshoppers, were seen.

#### IGUANIDÆ.

96. *Anolis principalis* (Linnaeus). Lion.

Key West, Boca Chica, Marquesas, Big Pine, No Name, Vaca, Grassy and Summerland Keys. Many bright green examples were seen on Key West among grasses and other green vegetation, from which they are distinguished with difficulty. Those on the ground, or on brown sticks, etc., were brown in color. I never saw the animal change to the negative of its surroundings. They are quick, though more easily captured than the other species.

#### CROCODILIDÆ.

97. *Alligator mississippiensis* (Daudin). Alligator.

Reported from several pools we saw on Little Pine Key, though I did not see any example during our stay. They were also reported from pools on Summerland Key, and were said to occasionally reach six feet in length.

#### DERMOCHELYDIDÆ.

98. *Dermochelys coriacea* (Vandell). Trunk Back.

Frequently taken about the Keys. Several shells were seen about Key West.

#### CHELONIIDÆ.

99. *Thalasseochelys caretta* (Linnaeus). Logger Head Turtle. Logger Head.

Reported as abundant in the past and still frequently taken. It, like both of the following species, is much sought after, and bids fair to become exterminated in a short time if the ruthless depredations of the turtle-fisher are not speedily checked. These animals, all of which

breed in suitable places in the Keys, are thus subjected to additional danger as their eggs are also held in demand. These are eagerly gathered when found and used as food.

100. *Eretmochelys imbricata* (Linnaeus). Hawk's Bill Turtle.

Shells of this animal were seen in Key West. It was reported as of frequent occurrence in past times.

101. *Chelonia mydas* (Linnaeus). Green Turtle. Turtle.

Hunted for food and the most familiar of the family. Several times newly laid eggs, most likely of this species, were found on the sandy beaches of the different Keys.

#### EMYDIDÆ.

102. *Malaclemmys littoralis rhizophorarum* subsp. nov. Terrapin. Diamond Back Terrapin. Plate IV.

Head large, heavy, flattened somewhat above, and below, and a little swollen laterally behind each eye. Eye large. Snout short, and rather obtuse. Jaws each with a broad horny covering. Mouth large, and its profile together with mandible convex. Legs and feet strong, furnished with stout claws, five on each anterior limb and four on each posterior. Claws on fore feet rather broad, and those on hind feet narrow and longer. Scales on limbs well developed superiorly. Tail short, conic, and rather weak.

Carapace slightly ovoid when viewed from above, with its greatest width opposite posterior portion of fourth vertebral plate. Anterior carapace a little emarginate. Carapace deepest when viewed laterally about middle of its length, or tops of crests of second and third vertebral plates highest with profile sloping down gradually in front and behind. Lower margin of carapace sloping gently down to a point above suture of seventh and eighth marginal plates, then turns upward and outward a little to descend again behind. Vertical and horizontal measurements of marginal plates forming bridge with plastron, or fifth, sixth and seventh, about equal. Edges of marginal plates from sixth backwards sharp and becoming more revolute to most posterior. Axillary and inguinal plates well developed. Each vertebral plate, except posterior which is evenly convex, with a median keel surmounted by a more or less well developed osseous tubercle posteriorly, and best developed proceeding to last. Each plate of carapace with conspicuous concentric rings. Plastron a trifle ovoid, and its greatest width would fall a trifle in advance of its middle or about middle of bridge. Front of plastron nearly truncate or its anterior edge only very slightly emarginate. Behind bridge sides of plastron nearly parallel to posterior margin of femoral plate where there is a prominent notch, and then more convergent to ends of anal

plates which are furnished with a deep notch on median line. Epidermal plates of plastron smooth.

Color in life. Carapace deep dusky, with perhaps faint or obscure darker mottlings. Inferior portion of marginal plates of carapace of the same shade of pale yellowish-brown as the plastron, though at each suture a broad blackish blotch. These blotches are most distinct and conspicuous on the bridge, those of posterior plates very narrow. Plastron dull or pale yellowish-brown, and articulation of each plate with a broad irregular blackish margin, at least anteriorly. Head, legs, feet and tail pale-slaty or plumbeous, and former speckled or spotted with a dark or dusky-slaty. On legs this is evident as each scale has a dark or slaty center. Jaws whitish or of a whitish horn-color. Top of head pale or light. Eye grayish. Claws horn-color, dark or brownish above.

Length of carapace  $7\frac{1}{8}$  inches.

Type, No. 16,570, A. N. S. P. Boca Grande Key, Florida. June 18, 1904. H. W. Fowler. Clarence B. Moore Collection.

This form is known to me only from the above described example, which was collected in a pool among the mangroves of Boca Grande Key together with *Natrix*. It did not appear to me to be especially abundant on the islands we visited, whether for seclusive habits or other reasons, I could not tell. It was reported from other islands within the limits of our trip, however. As it is highly valued as food it is much sought after. Provisionally, as a form of *Malaclemmys littoralis* of Prof. Hay,<sup>7</sup> from the Texas coasts, it may be recognized as a distinct subspecies. Although he had a very large series of individuals, the sutures of the marginal plates of the carapace are not described as black, which is the case in the example before me. His figures do not show this, and certainly the colored one of the adult is different. I have recently had the opportunity of examining a large series of several hundred living examples of *Malaclemmys centrata* (Latreille), through Dr. Samuel G. Dixon, in the markets of Philadelphia. Most of these were said to have been procured near Savannah, Georgia. Great variations in color were noticed, some individuals approaching the above described example very closely, while others had perfectly uniform plastrons, etc. Most of the variations, like those figured under *Emys concentrica* by Sowerby and Lear,<sup>8</sup> were found.

(*Rhizophora*, Mangrove.)

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<sup>7</sup> Bull. Bureau of Fish., XXIV, 1905, p. 18.

<sup>8</sup> Tort. Terrap. Turt., 1872. Four figures referable to Pls. 33-55, and 36, are not numbered in the copy before me.

## NEW, RARE OR LITTLE KNOWN SCOMBROIDS, NO. 3.

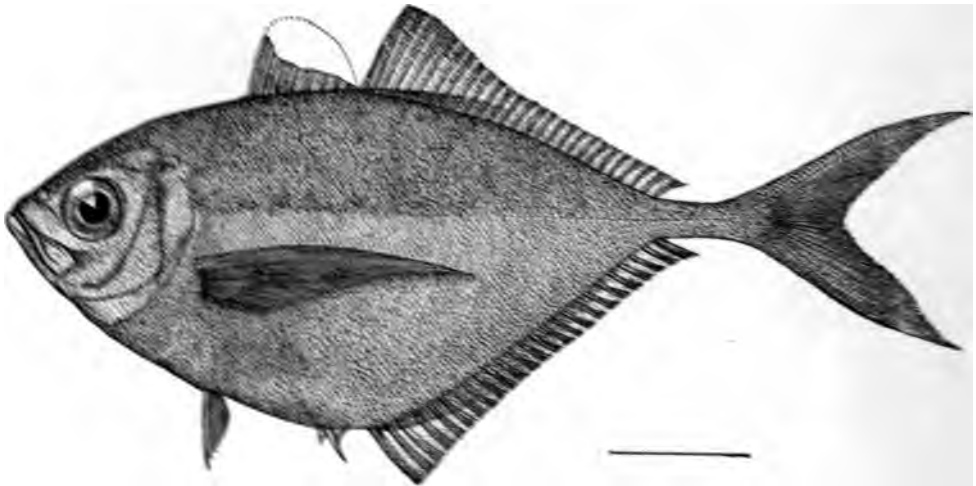
BY HENRY W. FOWLER.

## CHLOROSCOMBRINÆ.

*Chloroscombrus hesperius* sp. nov. Fig. 1.

Head 4; depth  $2\frac{1}{2}$ ; D. 1, VIII-I, 26; A. II-I, 25; P. II, 17; V. I, 5; scales 98? (squamation injured) in lateral line to base of caudal; depth of head, over middle of orbit,  $1\frac{1}{6}$  in its length; width of head  $2\frac{1}{2}$ ; mandible 2; third dorsal spine  $2\frac{2}{5}$ ; second dorsal ray 2; first anal ray  $2\frac{2}{5}$ ; ventral  $2\frac{1}{2}$ ; snout  $3\frac{2}{3}$  in head, measured from tip of upper jaw; eye  $2\frac{1}{2}$ ; maxillary  $2\frac{1}{2}$ ; interorbital space  $3\frac{2}{3}$ ; least depth of caudal peduncle  $5\frac{1}{2}$ ; upper caudal lobe  $3\frac{1}{2}$  in head and trunk; pectoral  $2\frac{1}{2}$ .

Body rather shorter than in *C. chrysurus*, strongly compressed,

Fig. 1.—*Chloroscombrus hesperius* Fowler.

ovoid, lower profile much more convex than upper and greatest depth at base of spinous anal. Caudal peduncle long, slender, compressed, and its least depth about 3 in its length.

Head deep, compressed. Snout short, forming obtuse profile, upper surface convex and upper jaw little produced. Eye rather large.



circular, and a little high and anterior. Adipose eyelid broad posteriorly, and covering a good portion of iris. Mouth obliquely vertical, rather small, and mandible well protruded. Maxillary reaching opposite front margin of eye, and its distal expanded extremity a trifle less than pupil or about  $\frac{2}{3}$  of orbit. Teeth minute, in bands in jaws, and also present on vomer, palatines and tongue. Tongue long, rather narrow, with rounded tip, and free in front. Lips thin, except lower on side of mandible. Interorbital space elevated and with a median elevated trenchant keel extending to occiput. Nostrils adjoining, near upper front rim of orbit and posterior larger.

Gill-opening extending forward about opposite posterior nostril. Rakers 10+33, slender, compressed, and longest  $\frac{2}{3}$  of orbit. Filaments about  $\frac{1}{2}$  length of longest rakers, and pseudobranchiæ about same size. Isthmus narrowly compressed, and its edge not trenchant.

Scales small, cycloid, and forming convex series bulging posteriorly over costal region. A few small scales on occipital region, postocular region, and on opercle above, head otherwise naked. Spinous dorsal and anal depressible in narrow scaly sheaths. Soft dorsal and anal anteriorly with basal scaly sheaths and rays more or less depressible within. Lateral line convex anteriorly, its bulge about equal to  $1\frac{1}{2}$  in straight portion, and no keel.

Spinous dorsal small, inserted nearly midway between tips of upper jaw and pectoral, and fourth or fifth spine probably longest (damaged). Soft dorsal inserted nearly midway between front rim of orbit and base of last dorsal ray, a little in front of straight part of lateral line, and first few rays elongated a little. Soft anal similar, inserted a little in advance of soft dorsal. Origin of spinous anal about last third in space between origin of ventral and that of soft anal, second spine probably a little longer (first damaged). Caudal rather large, lobes slender, pointed, and upper much longer. Pectoral long, slender, and reaching about opposite first third of base of anal. Ventral inserted a little behind origin of pectoral, small, both fins depressible in a groove extending to and containing vent, and when depressed thus reaching  $\frac{2}{3}$  of space to spinous anal.

Color in alcohol more or less silvery, and back above brownish. A small dull or pale brown spot on upper edge of opercle. Head pale brown above. Eye dull brassy. Fins pale brownish, spinous dorsal and upper anterior dorsal rays with a little brownish. A blackish blotch at base of upper caudal lobe.

Length  $6\frac{1}{2}$  inches.

Type No. 11,198, A. N. S. P. West Africa. Dr. H. E. Savage.

This species is closely related to *Scomber chloris* Bloch, with which it may possibly prove identical. However, that form, if the original figure is to be trusted, is very close to *Scomber chrysurus* Linnæus. It will be seen to differ from *C. chrysurus* in the slightly deeper form, larger eye, more anterior insertion of the anal, and longer pectoral. The gill-rakers are about the same.

(*Εσέριος*, western, with reference to the type locality.)

#### TRACHINOTINÆ.

##### GLAUCUS Walbaum.

Klein, in Walbaum, *Pet. Arted. Gen. Pisc.*, III, 1792, p. 585, with *Scomber amia* Linnæus as type, has priority over *Hypacanthus* Rafinesque, *Carat. Alcen. Nuov. Gen. Spec. An. Piant. Sicilia*, 1810 (April 1st), p. 43 (= *Hypacanthus* = *Hypacantha* = *Hypodis* = *Hypodys* Rafinesque = *Lichia* Cuvier = *Porthmeus* Valenciennes).

*Glaucus amia* (Linnæus) examined.

##### CAMPOGRAMMA Regan.

*Campogramma* Regan is distinct, as an examination of *Campogramma glaucus* (Linnæus) shows.

#### TRACHINOTUS Lacépède.

##### PAMPANO subgen. nov.

Type *Chatodon glaucus* Bloch.

Anterior rays of dorsal and anal prolonged so that they form long falcate lobes. Caudal long and triangular. Side with several dark transverse vertical bars, at least above. *Trachinotus glaucus* (Bloch) examined.

(*Pámpano* [Spanish], a common vernacular for the fishes of this genus and mostly written *Pompano*.)

Subgenus TRACHINOTUS Lacépède.

*T. ovatus* (Linnæus), *T. falcatus* (Linnæus), *T. goreensis* Cuvier and *T. carolinus* (Linnæus) examined.

#### STROMATEIDÆ.

##### STROMATEINÆ.

Subgenus STROMATEUS Linnæus.<sup>1</sup>

*Stromateus brasiliensis* sp. nov. Fig. 2.

Head  $4\frac{1}{2}$ ; depth  $2\frac{1}{2}$ ; D. V, 40; A. V, 37; P. II, 18; width of head  $1\frac{2}{10}$  in its length; snout  $3\frac{3}{4}$ ; eye  $4\frac{1}{4}$ ; maxillary  $3\frac{3}{4}$ ; interorbital space  $2\frac{3}{4}$ :

<sup>1</sup> *Stromateus fiatola* Linnæus examined.

least depth of caudal peduncle  $2\frac{7}{8}$ ; pectoral (damaged), a little less than head; upper lobe of caudal (damaged) about  $3\frac{1}{3}$  in head and trunk; about 125? scales in a lateral series from gill-opening below lateral line to base of caudal.

Body ovate, deep, compressed, and greatest depth about origins of rayed dorsal and anal. Back rather trenchant before dorsal. Caudal peduncle compressed, its least depth about  $\frac{2}{3}$  of its length.

Head deep, compressed, blunt in front, profiles steep, and upper a little concave in front. Snout blunt, convex and profile in front nearly vertical. Eye rather small, circular, a little low, and posterior margin

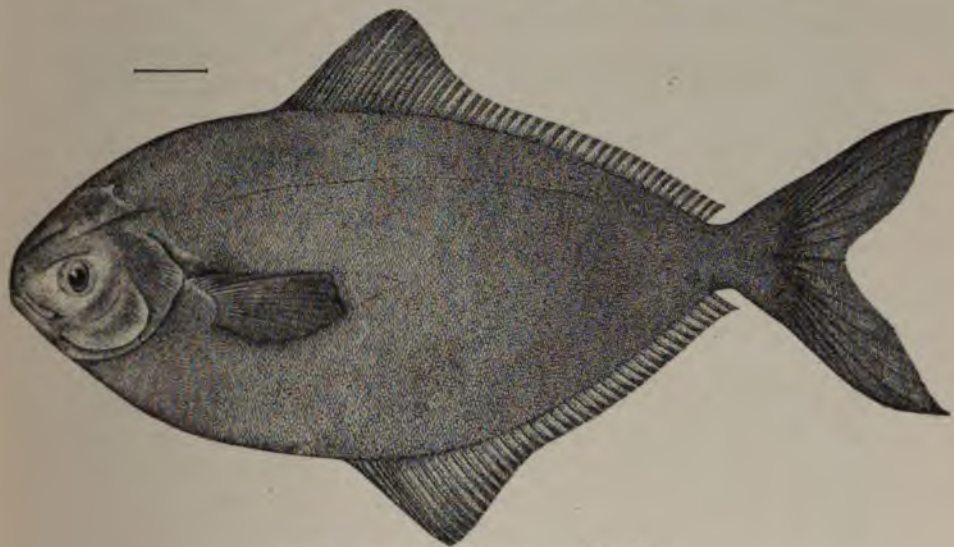


Fig. 2.—*Stromateus brasiliensis* Fowler.

about midway in length of head. Adipose eyelid well developed, and concealing a good portion of eye. Mouth a little inclined, small, and mandible hardly protruded in front. Maxillary not quite reaching front rim of orbit, and distally expanded till about equal to pupil. Teeth minute, uniserial, and forming a rather weak cutting edge. Palatines with minute asperites. Vomer edentulous. Tongue smooth, broad, rounded, and free in front. Nostrils adjoining, a little nearer front of snout than front margin of eye, and posterior larger. Interorbital space elevated, trenchant, a keel beginning at the internasal region. Preopercle broad and with radiating flutings. Opercle striate.

Gill-opening extending forward about opposite front margin of eye. Rakers 5+13, pointed, longest about  $\frac{2}{3}$  of longest filaments which are  $\frac{2}{3}$  of orbit. Pseudobranchiæ a trifle longer than longest raker. Isthmus rounded.

Scales small, and extending well out on most of fins, almost entirely on dorsals and anals where they are greatly reduced and crowded. Head naked except cheek and opercle. Lateral line damaged, convex at least anteriorly.

Dorsal apparently over middle of pectoral, spines graduated to last which is longest though not as high as longest anterior rays. Anals similar though origin of spinous well posterior, a little before end of pectoral. Only first 7 or 8 rays of rayed dorsal and anal a little longer than others. Caudal large, forked, and lobes rather broad. Pectoral broad, its origin a little above lower rim of orbit. Anus placed nearly opposite origin of spinous dorsal.

Color in alcohol pale brown, mostly uniform, or the back only a trifle darker and marked with indistinct traces of numerous crowded slightly darker or grayish spots. Fins pale brown, pectoral a trifle darker. Iris dull brassy.

Length 13 $\frac{1}{4}$  inches.

Type No. 11,354, A. N. S. P. Rio Grande do Sul, Brazil. Mus. Comp. Zool. Cambr., Mass.

One example which does not agree with Gay's figure of *Stromateus maculatus*.<sup>2</sup> This is very poor, as no squamation whatever is indicated, the fins are naked, also the head, there is no adipose eyelid, opercle and preopercle without striæ, and the spots are greenish-golden, the lower ones brighter. The dorsal shows VI, 38, and the anal III, 32. Jenyn's Chiloe example<sup>3</sup> had D. VII, 41, and A. V, 50, and the one from Port St. Julien in Central Patagonia is possibly identical with *S. brasiliensis*. The original account of *S. maculatus* by Valenciennes states that the spots are yellow.

(*Brasiliensis*, of Brazil.)<sup>4</sup>

PTERORHOMBUS subgen. nov.

Type *Fiatola fasciata* Risso.

*Fiatola* Risso, Hist. Nat. Eur. Merid., III, 1826, p. 289 (*fasciata*). (Not of Cuvier.)

Small ventrals present. *Stromateus fasciata* (Risso) examined.

<sup>2</sup> *At. Hist. Chile, Zool.*, 1854, "lam 3bis," fig. 1.

<sup>3</sup> *Zool. Voy. Beagle*, IV, Fish, 1842, p. 74.

<sup>4</sup> *Hist. Nat. Poiss.*, IX, 1833, p. 296.

(Πτερόν, fin, with reference to ventral; ῥόμβος, *Rhombus*, a rhomb or diamond, and formerly applied to species of *Seserinus*, *Palometa* and *Poronotus*.)

**SESERINUS** Quoy and Gaimard.

*Seserinus* Cuvier, in Quoy and Gaimard, *Voyage de l'Uranie*, *Zool.*, Jan.-Mar., 1825, p. 384 (*xanthurus*), has priority over *Peprilus* Cuvier, *Règne Animal*, Ed. II, II, 1829, p. 214 (*longipennis* = *paru*), now in use. Cuvier's account in *l.c.*, Ed. I, II, 1817, p. 342 (*alepidotus* = *paru*) cannot be used on account of its vernacular form. *Seserinus xanthurus* Quoy and Gaimard examined.

**NOMEIDÆ.**

*Psenes chapmani* sp. nov. Fig. 3.

Head 3; depth  $1\frac{1}{2}$ ; D. X, I, 23; A. III, 25; P. II, 17; V. I, 5; scales 60 in lateral line to base of caudal; 9 scales vertically between origin of soft dorsal and lateral line, and about 25 vertically between latter and origin of soft anal; width of head 2 in its length; depth of head over middle of eye about equal to its length; snout  $3\frac{1}{2}$ ; eye 3; maxillary 3; interorbital space 3; least depth of caudal peduncle 3; pectoral  $1\frac{1}{2}$ ; ventral  $1\frac{1}{2}$ .

Body deep, compressed, rather ovoid, profiles similar, and greatest depth about origin of soft anal. Caudal peduncle compressed, and its least depth about  $1\frac{1}{2}$  in its length.

Head deep, compressed, profiles steep, and similar, blunt in front. Snout short, blunt, convex, upper jaw but slightly projecting. Eye rather large, circular, anterior, and its lower margin about midway in depth of head. Mouth small, jaws about even, and maxillary extending obliquely down barely opposite front margin of orbit. Teeth in jaws uniserial, rather pronounced, well separated and sharp. No teeth on roof of mouth. Tongue rounded, and free in front. Nostrils small, very close together, and well in front of eye above. Interorbital space convexly elevated.

Gill-opening extending forward about opposite front rim of orbit. Rakers 11 + 20, clavate, a little shorter than filaments which are about 2 in orbit. Pseudobranchiæ nearly as large as filaments.

Scales small, those above lateral line forming series parallel with its course, and those below forming horizontal longitudinal series. Except interorbital space, supraocular region, nasal region, snout, mandible, and branchiostegal region, head is covered with scales, those on middle of cheek and opercle largest. About 7 series on cheek. Scales in front of spinous dorsal small and crowded. Vertical fins

almost entirely scaled over most of basal regions which form sheaths for spinous dorsal and anal and also rayed dorsal and anal at least anteriorly. Only ends of caudal lobes naked. Scales on bases of these fins also small and crowded. Base of pectoral scaly. Ventral with innermost ray united to abdomen by a membrane and both fins depressible in a groove. Lateral line curved similarly with profile of back, also approaching it more closely posteriorly, and extending a little above middle of side of caudal peduncle. Lateral line not extending on base of caudal and tubes simple.

Spinous dorsal inserted a trifle in advance of origin of pectoral, spines flexible, and graduated to fourth which is longest. Soft dorsal

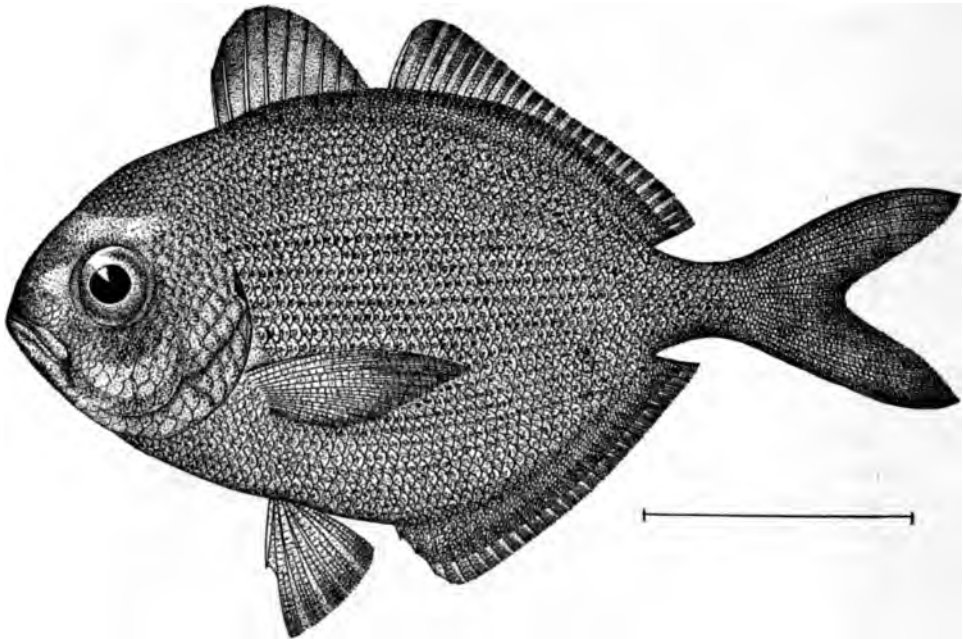


Fig. 3.—*Psenes chapmani* Fowler.

inserted a little nearer tip of snout than base of caudal or about over middle of pectoral, and fin a little higher anteriorly. Anal similar, spines graduated to third which is longest, and rayed fin inserted perhaps a trifle in advance of rayed dorsal. Caudal forked, lobes rather long and pointed. Pectoral broad, hardly reaching half way to tip of last anal ray. Ventral inserted a little behind origin of pectoral, and reaching second anal spine. Anus in ventral groove before tip of ventral fin.

Color in alcohol rich warm brown, lower surface paler, evidently silvery in life. Along each series of scales on side of body a narrow streak or line of darker color than general body-color. Above lateral line these also follow series of scales parallel with it, and below it they are also horizontal. Lower side of head including cheek and opercle spotted or dotted with brown. Spinous dorsal and ventrals dusky-brown. Rayed dorsal with more or less pale dusky-brown on its outer portion. Caudal and anal paler. Pectoral pale brownish. Inside of mouth pale. Iris brassy. Peritoneum whitish.

Length  $3\frac{1}{2}$  inches.

Type No. 14,621, A. N. S. P. Taken on the surface of the open Atlantic in Lat.  $24^{\circ} 21' N.$ , Long.  $34^{\circ} 32' W.$  (northwest of Cape de Verde Islands). Dr. W. H. Jones. Also seven paratypes with same data. The very young differ in having the body marked with large blotches, no longitudinal lines on side, and lower parts of head together with thorax marked with numerous brown spots. Larger example with 28 rays.

Young examples also from the open Atlantic's surface in Lat.  $23^{\circ} 53' N.$ , Long.  $53^{\circ} 06' W.$  (northwest of the Lesser Antilles). Another also from the Atlantic in the Saragossa Sea. All from Dr. William H. Jones.

The East Indian form<sup>5</sup> needs comparison. *Psenes guttatus* apparently differs in coloration, especially the spotted thorax and lower surface of the head. None of my examples show a trace of the bluish bar indicated by Valenciennes. *Psenes edwardsii* Eigenmann<sup>6</sup> has a little different radial formula and about 140 scales in the lateral line.

(Dedicated to Dr. Henry C. Chapman, Professor of Institutes of Medicine and Medical Jurisprudence in the Jefferson Medical College of Philadelphia, who has contributed many valuable additions to the ichthyological collections of the Academy.)

#### LEPODIDÆ fam. nom. nov.

##### LEPODUS Rafinesque.

*Carat. Alcin. Gen. Spec. An. Plant. Sicilia*, 1810, p. 53 (*saragus = raii*) is to be used, as *Brama* Klein, in Walbaum, *Pet. Arted. Gen. Pisc.*, III, 1792, p. 586, with *Cyprinus brama* Linnæus as type, preoccupies *Brama* Schneider, *Syst. Ichth.*, Bloch, 1801, p. 98, based on *Sparus raii* Bloch. The Pomfret, *Lepodus raii* (Bloch), examined.

<sup>5</sup> *Hist. Nat. Poiss.*, IX, 1833, p. 193, Pl. 265.

<sup>6</sup> *Bull. U. S. Fish. Comm.*, XXI, 1901 (1902), p. 35, fig. From under a medusa, 30 miles south of Newport, Rhode Island.

**CORYPHÆNIDÆ.**

*Coryphæna equisetis* Linnæus is of perfectly correct form, and not to be emended to *C. equisetis* as some writers seem to suppose. Further, it is not a misprint for the latter but simply a different form of the same. A small example, 25 mm. in length, from between the Cape de Verde Islands and Montevideo (Uruguay), examined.

**PEMPHERIDÆ.**

**PEMPHERIS** Cuvier.

**PRIACANTHOPSIS** subgen. nov.

Type *Pempheris mülleri* Poey.

Anal rays 25 to 32. *Pempheris mülleri* Poey examined.

(*Πρίων*, saw; *ἀκανθα*, spine; *ὄψις*, appearance. So named as these fishes resemble the young of *Priacanthus*.)

This paper concludes the series.



## MOLLUSCA OF THE SOUTHWESTERN STATES. II.

BY H. A. PILSBRY AND J. H. FERRISS.

The present paper deals with mollusks of Texas, New Mexico and Arizona, collected chiefly by the authors in 1903, and not included in the first paper of this series.<sup>1</sup> No attempt has been made to present complete faunas; but in connection with the previous paper, about all the reliable data extant upon the snail faunas of the Chiricahua and Huachuca ranges in southeast Arizona and the eastern and southern borders of the Lower Sonoran area in Texas will be found herein.<sup>2</sup> It has not been thought expedient to repeat data elsewhere accessible.

For the student of molluscan distribution, the life zones of the United States as mapped by Dr. Merriam<sup>3</sup> emphasize the secondary and not the primary facts of distribution. The laws of temperature control, which he has developed with keen insight, do not define transcontinental zones of primary import zoologically. These zones are secondary divisions of vertical life areas of which the molluscan faunas were evolved in large part independently. The Sonoran fauna is probably intermingling more now with that of eastern North America than at any former time, at least so far as such sedentary forms as land mollusks are concerned.

Similar conclusions have been reached by Mr. A. E. Brown in dealing with Texan reptiles.<sup>4</sup> The results of his study "establish three facts, hitherto not wholly free from uncertainty: first, that the boundary between the Austroriparian and Sonoran reptilian faunas lies approximately between the 96th and 98th meridians of longitude in Texas; second, that the restricted Texan district of Cope is not Austroriparian but Sonoran; third, that transcontinental zones of distribution cannot be maintained in the Medicolumbian region for reptiles."

<sup>1</sup> *Proc. A. N. S. Phila.*, 1905, p. 211.

<sup>2</sup> Some New Mexican records, chiefly from material collected by Prof. T. D. A. Cockerell in the upper Pecos valley, are added.

<sup>3</sup> Biological Survey, U. S. Dept. of Agriculture, Bulletin No. 11, Map. *North American Fauna*, No. 25, Plate I.

<sup>4</sup> Texas Reptiles and their Faunal Relations, *Proc. A. N. S. Phila.*, 1903, pp. 543-558.

Post-Glacial Nearctic Centers of Dispersal for Reptiles, *Proc. A. N. S. Phila.*, 1904, p. 464.

" . . . the community in reptiles between the Sonoran and the Austroriparian is much less than that between the Sonoran and the Central; it is, in fact, limited to widely ranging genera . . . the separate identity of these two faunas [Sonoran and Austroriparian], as far back as they can be traced, confirms the conclusion already reached, from their present distribution, that the association of the Sonoran with the Austroriparian into one transcontinental zone is unnatural."

This terse statement only requires the substitution of "mollusks" for "reptiles" to serve as a summary of the results of our present investigation. In land mollusks, as in reptiles, the Sonoran types have pushed farther into the humid Austroriparian than the eastern types into the Sonoran area. *Bulimulus* and the *texasiana* group of *Polygyra* are cases in point; while Eastern subgenera of *Polygyra*, and practically all Austroriparian forms except the minute, widely ranging genera, stop short at the rise marking the approximate limit of the Cretaceous formation and the Sonoran area in Texas. The common boundary of the Austroriparian and Sonoran, while surprisingly sharp for continuous areas, is deeply accidented by the river valleys, which carry very narrow Austroriparian ramifications into Sonoran borders. Thus, along the San Marcos river in Hays county, the Guadalupe river in Comal county, and the San Antonio river in Bexar county, an Austroriparian fauna with such Eastern forms as *Omphalina*, *Polygyra thyroides*, *P. monodon fraterna*, *P. auriformis*, *P. roemeri*, *Bulimulus d. liquabilis*, etc., is found, while the fauna on the bluffs or away from the streams is frankly Sonoran. Farther southwest, the Austroriparian forms are wholly wanting, even where moist local conditions prevail, as in the immediate vicinity of the streams of Val Verde county.

A list of the forms characteristic of the eastern or lower portion of the Sonoran in Texas (Texan District of Cope) follows:

<i>Praticolella berlandieriana</i>	<i>Strobilops l. texasianus</i>
<i>Thysanophora hornii</i>	<i>Zonitoides nummus</i>
<i>Polygyra hippocrepis</i>	<i>Vitrea indentata umbilicata</i>
<i>Polygyra texasiana hyperolia</i>	<i>Vitrea dalliana roemeri</i>
<i>Polygyra t. texasensis</i>	<i>Euconulus chersinus trochulus</i>
<i>Polygyra mooreana</i> <sup>5</sup>	<i>Helicodiscus eigenmanni</i>
<i>Bulimulus d. mooreanus</i>	<i>Planorbis carus</i>
<i>Bulimulus d. ragsdalei</i>	<i>Planorbula obstructa</i>

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<sup>5</sup>This species extends somewhat into the Austroriparian.

<i>Bulimulus d. pecosensis</i>	<i>Goniobasis comalensis</i>
<i>Bulimulus alternatus mariæ</i>	<i>Paludestrina seemani</i>
<i>Holospira roemeri</i>	<i>Paludestrina diaboli</i>
<i>Holospira goldfussi</i>	<i>Ammicola comalensis</i>
<i>Microceramus texanus</i>	<i>Cochliopa riograndensis</i>
<i>Euglandina singleyana</i>	<i>Potamopyrgus spinosus</i>
<i>Bifidaria procera cristata</i>	<i>Valvata micra</i>

Nine genera of this list are not known to occur in the Austroriparian or humid region of Texas. For list of the latter fauna, the student is referred to the catalogue of Mr. J. A. Singley, cited below, from which a long list of Austroriparian forms of Eastern type may readily be compiled.

The first list of Texan mollusks of any extent was published by Römer in his excellent work on Texas, 1849. Numerous references to the terrestrial mollusks will of course be found in Binney's successive volumes. In 1878 Mr. A. G. Wetherby<sup>6</sup> published some notes on the forms he found in eastern Texas (*American Naturalist* for 1878, pp. 184, 254). The principal source of information, however, is Mr. J. A. Singley's Contributions to the Natural History of Texas, part I, Texas Mollusca, published in the *Fourth Annual Rep. Geol. Survey of Texas*, 1893. In this list Mr. Singley has included with the records of his own extensive collecting, others from many sources, so that the records are of unequal value. The Texan list stands much in need of revision and a good many names thereon are doubtless to be rejected, either because the forms do not occur in Texas, as in the case of *Ampullaria*, or because of wrong identifications; yet the work cannot be done until resident naturalists take it up.

#### HELICINIDÆ.

*Helicina orbiculata tropica* 'Jan' Pir.

Texas: San Marcos, Hays county; Comal county, around New Braunfels; San Antonio, Bexar county; two miles north of Hondo, Medina county; Del Rio, Devil's river and High Bridge of the Pecos, Val Verde county.

Some colonies are all white; others are mingled with red or blue shells.

#### HELICIDÆ.

*Fraticolella berlandieriana* (Moric.). Figs. 1, 2.

Texas: San Marcos, Hays county; Guadalupe river above New

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<sup>6</sup> By error Mr. Wetherby's name was printed "W. G. Weatherby "

Braunfels, Comal county; San Antonio, Bexar county; Hondo river, two miles north of Hondo, Medina county; Del Rio, Val Verde county.

Mr. Ferriss took some thin, translucent specimens, 8 x 10 mm., at Smithville. The shell varies from 9.8 to 11.7 mm. diam. The pub-

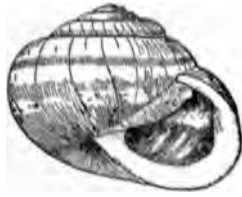


Fig. 1.

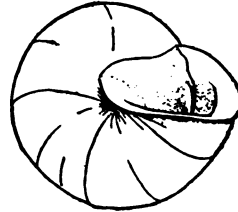


Fig. 2.

lished figures do not show that there is frequently a short lamellar tooth or callous on the parietal wall near the suture, a short distance within, as shown in the figured specimen from the Guadalupe river near New Braunfels.

***Thysanophora hornii* (Gabb).**

Texas: Hondo river, near Hondo, Medina county; Rio San Filipe, near Del Rio; Devil's river, west of Del Rio, and Pecos river at the High Bridge, Val Verde county, all in river drift.

New Mexico: Florida mountains, near Deming, Grant county.

Arizona: Cochise county; Cave creek canyon in the Chiricahua mountains; Fort Bowie; drift of San Pedro river at Benson, and Manilla mine, at the west end of the Huachuca mountains.

This small species is a typical *Thysanophora*, closely related to the type of the genus. It varies but little throughout its extensive range, unless it be in the cuticular lines and hairs, which are worn off of the river-drift specimens. It has not before been reported in this country from east of Cook's, Grant county, N. M. Our collection of 1903 extended its known range in the United States more than 500 miles eastward, to the border of the Staked Plains in central-southern Texas. Further localities in Arizona are given in *Nautilus*, XII, p. 99.

In Mexico, *T. hornii* has been collected at Topo Chico, near Monterrey, Nuevo Leon, and at Victoria, Tamaulipas (*Proc. A. N. S. Phila.*, 1903, p. 763). It is therefore one of the widely distributed species of the States both north and south of the international boundary in the Sonoran area.

***Polygyra auriformis* Ed.**

*Helix auriformis* Bland, Ann. Lyc. Nat. Hist. of N. Y., VII, p. 37 (1858).

? *Helix sayi* Wood, Index Testaceologicus, Suppl., p. 22, pl. 7, p. 34 s (1858).

Texas: Galveston (J. H. Ferriss); Calhoun county (Hubbard);

Austin and San Antonio (Pilsbry, 1885); along the Guadalupe river, three or four miles above New Braunfels (Ferriss and Pilsbry). Singley adds the localities Bastrop and Burleson counties. It is an Austro-riparian species which reaches into the borders of the Lower Sonoran area along the river bottoms.

While the identity of Wood's *H. sayi* with *auriformis* is not established with sufficient certainty to make a substitution advisable, in our opinion, yet there can be no doubt that Wood had either that species or one of its immediate allies. *Helix sayi* of Binney, 1840, being a homonym, may be changed to *Polygyra sayana* (*Terrestrial Mollusks*, III, pl. XXIII).

***Polygyra hippocrepis* (Pfr.).** Figs. 3, 4.

The known range of this curious snail is exceedingly restricted. It has been found only near New Braunfels, in Comal county, Texas. We found it in abundance in April, 1903, on the west side of the Guadalupe river about four to six miles north of New Braunfels, under stones near and at the foot of the bluff, with *Holospira goldfussi*. Another place much nearer the town is on the rocky wooded hillside above the springs of Comal creek, where we found a few living ones. This place is just beyond the pleasure gardens.



Fig. 3.

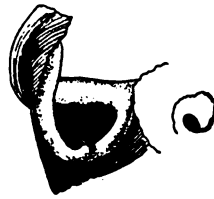


Fig. 4.

The structure of the aperture of *P. hippocrepis* has never been fully described or figured. The parietal tooth is not V-shaped as in other *Polygyras*, but U-shaped, hence the name *hippocrepis*—horseshoe. There is an internal tubercle on the columella, as in *P. mooreana*. The upper and lower lip-teeth enter and arch towards each other, forming a U-shaped curve, which stands close to but a little deeper than that formed by the parietal tooth. Where the two entering teeth join there is a notch and a delicate slender hook with the point curved towards the adjacent basal wall projecting forward. The immersion of the originally lower lip-tooth gives room for a secondary callous ridge along the basal lip, as shown in fig. 4.

These structures form in their way a more perfect barrier perhaps than that produced by other means in *P. auriculata* and *uvulifera*. The species stands isolated at present. It is perhaps an aberrant and highly evolved relative of the Tennessee-Arkansas group of *P. jacksoni*, etc.

***Polygyra texasiana*** (Moricand). Pl. V, figs. 16, 17, 20.

Specimens of typical *P. texasiana* were taken by us in Hays, Comal and Bexar counties, Texas. Ferriss took it at Galveston. The type locality is "Texas." In this widespread form the last two whorls are strongly rib-striate above, the riblets rapidly diminishing on preceding whorls; the embryonic whorl is smooth and glossy. The ribs are strongest just behind the lip, and here continue upon the periphery or to the base, which is elsewhere nearly smooth or merely rippled. Fresh shells show a reddish peripheral band on the pale brownish-corneous surface. Specimens figured are from the west side of the Guadalupe river above New Braunfels, Texas. Alt. 5, diam. 11 mm.

Along the Rio Grande *P. texasiana* occurs with transition forms to *P. t. hyperolia*. See below.

*Form with striate base.* In some localities the ribs of the upper surface continue upon the base (pl. V, figs. 18, 19, Calhoun county, Texas), the other characters being unchanged. There are transitions to the normal sculpture of *texasiana* in some specimens, and we do not think it desirable to distinguish this form at present by a special name. Its distribution must be more fully worked out than we have been able to do. Calhoun county is on the Gulf coast near the southern angle of the State.

***P. texasiana hyperolia*** n. subsp. Pl. V, figs. 13 14, 15.

Shell more depressed than *texasiana*, glossy, very finely striate, almost smooth, above and below, with several riblets behind the lip-constriction. Uniform brownish-corneous or paler beneath, without a peripheral band. Aperture smaller and slightly more oblique than in *texasiana*. Alt. 4, diam. 9.3 to 10 mm.

The type locality is the high land west of Devil's river. This is the common *Polygyra* along the Rio Grande in Val Verde county, extending north and northwest. The specimens from down the river, at Hidalgo, . . . county, and Laredo, Webb county (collected by Singley), are either *texasiana* or transitional between *texasiana* and *hyperolia* in sculpture. At Del Rio, along the Rio San Filipe, Ferriss and I found still the *texasiana* and transition forms.

On the high land west of the Devil's river, Val Verde county, we found *hyperolia* in some numbers, under prostrate Yucca trunks and

sometimes concealed in the shelter of the downward-drooping dead leaves on standing *Yuccas*. From this region they have been washed into the Devil's river, where bleached shells are abundantly found in the drift débris.

We also took specimens in the high land along the Pecos river, near the High Bridge (Viaduct, on some maps), east of the river, and in drift débris in the canyon.

In the interior counties of Texas we took specimens in the drift of the Hondo river, Medina county, about two miles north of Hondo.

Much farther northward Mr. Ferriss found *hyperolia* at Colorado City, Mitchell county, Texas.

In New Mexico Prof. J. D. Tinsley collected it on South Spring creek, near Roswell, in the Pecos valley, where it occurred fossil in a bed of white marl, three to four feet below the surface. It is not now found living in that locality. We are indebted to Prof. Cockerell for these specimens.<sup>7</sup>

*P. t. hyperolia* varies about as much as *texasiana* in size. Specimens from west of Devil's river measure from  $3.8 \times 8$  mm., with  $4\frac{1}{2}$  whorls, to  $4.2 \times 11$  mm., with 5 whorls.

This variety is not the *Helix (Polygyra) tamaulipasensis* of Lea, which is typical *P. texasiana*, as I have ascertained by a comparison of the type kindly made for me by Dr. W. H. Dall.

*Polygyra texasiana texasensis* (Pils.). Pl. V, figs. 11, 12.

*Polygyra texasensis* Pils., Nautilus, XVI, p. 31, July, 1902.

Similar to *P. t. hyperolia* in the depressed shape and smooth surface, without riblets above; but decidedly larger, with about  $5\frac{1}{2}$  whorls, the umbilicus broader than is usual in the other forms of the species.

Alt. 5.2, diam. 12.5 mm.

Alt. 5.8, diam. 12.5 mm.

Alt. 5.8, diam. 13.7 mm.

Colorado City, Mitchell county, Texas; types collected by James H. Ferriss in 1902, No. 83,258, A. N. S. Phila.

This is a large edition of *P. t. hyperolia*, and further collections from the almost unknown northwestern half of Texas are needed to determine whether it is really distinct enough from that subspecies to call for recognition of the latter by name. In the large series of *hyperolia* collected there were, however, no forms as large as *texasensis*.

*Polygyra mooreana* (W. G. Binn). Pl. V, figs. 4-10.

This species stands close to *P. texasiana*, but the shell is smaller than

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<sup>7</sup> Reported as *P. triodontoides* in *The Nautilus*, XIII, November, 1899, p. 84.

any but the smallest *texasiana*, and with about the same number of whorls (5 to  $5\frac{1}{2}$ ) appears more closely coiled. It is constantly distinct by the elongated columellar tubercle within the last whorl (shown in fig. 9). This tubercle seems to be what Binney erroneously describes as "an internal transverse tubercle on the base of the shell"—an expression which would lead one to expect such a structure as that found in the *Stenotremas*. Binney states that the color is "white," but fresh shells are brownish-corneous, a little paler and somewhat transparent at the base. The diameter varies from 6.5 to 8 mm. Variation in the degree of elevation is shown in the figures.

*P. mooreana* was originally described from Washington county, Texas. We took specimens at Smithville, Bastrop county, San Marcos, Hays county, around New Braunfels, Comal county (figs 4-7), and on the Hondo river north of Hondo, Medina county (figs. 8, 9, 10), everywhere in copious quantity. There are also specimens before us from Washington county, Belton, Fort Worth, Waco, Austin and Lee county. Further records are given by Mr. Singley in his valuable catalogue. It was taken at Galveston by Ferriss.

*Polygyra mooreana tholus* (W. G. Binn). Pl. V, figs. 1, 2, 3.

Larger than *mooreana*, with the last whorl far more openly coiled below, exposing more of the penultimate whorl in the much wider umbilicus. Specimens from Washington county measure:

Alt. 5.5, diam. 11, width of umbilicus 4.2 mm.; whorls 7.

Alt. 4, diam. 8.2, width of umbilicus, 3 mm.; whorls 6.

This form holds such a relation to *P. mooreana* as *P. d. sampsoni* to *P. dorjeuilliana*, being very openly coiled beneath, with a deep and very long groove on the last whorl within the umbilicus. The internal ridge is like that of *P. mooreana*. It seems to be comparatively local in distribution and is certainly rare. We have never seen a fresh specimen. It was described from Washington county, Texas, the locality of the specimens figured. It is in the collection of the Academy also from Calhoun county. Ferriss took a few specimens at Galveston, and Singley found it in Fort Bend and Brazos counties. Von Martens reports a worn specimen found by Friedel at Vera Cruz, Mexico.

*Polygyra roemerii* (Pfr.).

Smithville, Bastrop county, Texas (Ferriss); San Antonio, Bexar county (Pilsbry and Ferriss); near New Braunfels, Comal county, one specimen (Pilsbry).

#### BULIMULIDÆ.

The genus *Bulimulus* in Texas has caused much perplexity to students. Many and diverse have been the views held as to the rank



and identity of the several forms. Several times since the first visit of one of us to Texas, in the winter of 1885-86, they have been carefully studied anew, with each time larger materials and better knowledge of the country. To the specimens already in the museum of the Academy about 1,000 were added by our expedition of 1903, from central and western Texas and Indian Territory.

The series is divisible into two species, *B. dealbatus* and *B. alternatus mariae*; the first further split into numerous local races or subspecies. The typical forms of *B. alternatus* and *B. schiedeanus* do not, so far as we know, extend into Texan territory; both were described from Mexico where they range over a large area. *B. patriarcha* W. G. B., unquestionably a form of *schiedeanus*, was also described from Mexico (Buena Vista), and we have seen no specimen of it from within our borders.\*

In the United States, *Bulimulus* has not been found west of the neighborhood of El Paso. We know nothing of what forms live in the State northwest of a line from Austin to San Antonio, or north of the Southern Pacific Railroad from San Antonio westward to El Paso. Beyond some extension of the ranges of *B. dealbatus mooreanus* and *B. alternatus mariae*, little is to be expected from the great unknown area.

The following forms are now recognized:

1. *B. dealbatus mooreanus* W. G. B., Pfr. Arid region of central and south Texas.
2. *B. d. liquabilis* Rve. Eastern and southeastern Texas.
3. *B. dealbatus* Say. Alabama to Kentucky, west to Kansas.
4. *B. d. ozarkensis* P. and F. Northern and western borders of the Ozark uplift.
5. *B. d. ragsdalei* Pilsbry. Bluffs of Red river and southwestern Texas.
6. *B. d. pecosensis* P. and F. Southwestern Texas.
7. *B. d. pasonis* Pilsbry. El Paso, western Texas.
8. *B. alternatus mariae* (Albers). Southern Texas.

Of these forms, the anatomy of *B. d. mooreanus*, *B. d. liquabilis*, *B. d. ragsdalei*, *B. d. pecosensis* and the Val Verde county race of *B. alternatus mariae* has been examined more or less fully. All agree in having a rather short, fusiform penis with a basal sheath which in-

\* We do not mean to deny that the forms mentioned occur in Texas. The counties along the Rio Grande west of the mouth of the Pecos are still unexplored for shells, and *B. schiedeanus* especially may turn up in this region.

cludes the vas deferens; a rather long and slender epiphallus, and a flagellum. An atrium can scarcely be said to be developed, but the vagina is rather long in all the forms. The globular spermatheca is borne on a long duct, which is lightly bound to the oviduct and is usually somewhat swollen near the middle. The right eye-retractor passes between the ♂ and ♀ branches, and there is an excessively weak and short penial retractor about 1 mm. from the end of the flagellum, and inserted on the lung floor.

*B. a. mariæ* differs strongly from all forms of *B. dealbatus* by the great length of the penis with its appendages, and of the duct of the spermatheca. Moreover, the penial organs are longer than the spermathecal duct, while in *mooreanus* and *pecosensis* the spermathecal duct is the longer. These differences confirm the opinion, derived

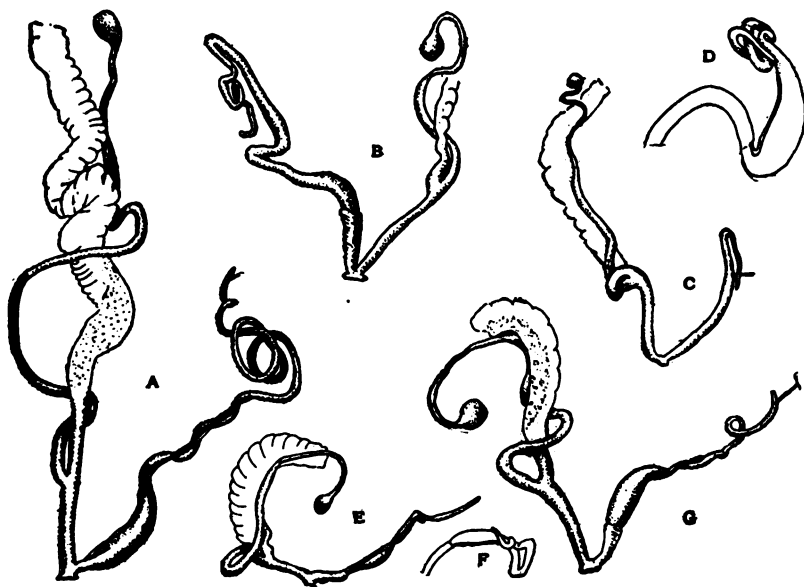


Fig. 5.—A, *Bulimulus a. mariæ*. B, *B. d. liquabilis*. C, *B. d. pecosensis*. D, penis of a fully mature individual of same. E, *B. d. ragsdalei*. F, penis of another individual. G, *B. d. mooreanus*. Fig. D  $\times 2\frac{1}{2}$ ; the other figures  $\times 2$ .

from a study of the shells, that *B. alternatus* and *dealbatus* are well differentiated specifically.

The measurements of the genitalia in millimeters follows:

	Total length of penis, epiphallus and flagellum.	Length of penis (to insertion of vas deferens).	Length of vagina.	Length of sperma- theca with duct.	Museum number.
<i>B. a. maria</i>					
Pecos river	58	34	7	5	84,627
Del Rio	45	29			84,635
<i>B. d. liquabilis</i>					
San Marcos	36	29	11	27	91,396
<i>B. d. mooreanus</i>					
Guadalupe river	23	16	6	30	84,628
<i>B. d. ragsdalei</i>					
Devil's river	16	10.5	5	17	84,638
<i>B. d. pecosensis</i>					
	19	11.5	6	20	84,618
	24	1.5			

*Proceedings of the Academy of Natural Sciences  
of Philadelphia, 1906.*

Page 133—Under heading *Length of Spermatheca with duct*, first line of table, change 5 to 50. On last line of table change 1.5 to 15.

Distribution, eastern division of the Lower Sonoran in Texas. Originally described from "Washington and DeWitt counties, Texas." Specimens from both of these are before us, and also from Hays, Comal, Guadalupe, Bexar, Medina, Frio, Uvalde and Victoria counties. Some shells from Fort Worth and Waco, in northern Texas, are also like *mooreanus*, while others resemble *B. d. liquabilis*.

*B. d. mooreanus* is smaller, thinner and smoother than the Mexican *B. schiedeanus* (Pfr.), but intergrades with *B. d. liquabilis* Rve. through certain specimens having ragged dark streaks, chiefly on the spire, such as fig. 5 of pl. VI. In the main, the subspecies is quite uniform

cludes the vas deferens; a rather long and slender epiphallus, and a flagellum. An atrium can scarcely be said to be developed, but the vagina is rather long in all the forms. The globular spermatheca is borne on a long duct, which is lightly bound to the oviduct and is usually somewhat swollen near the middle. The right eye-retractor passes between the ♂ and ♀ branches, and there is an excessively weak and short penial retractor about 1 mm. from the end of the flagellum, and inserted on the lung floor.

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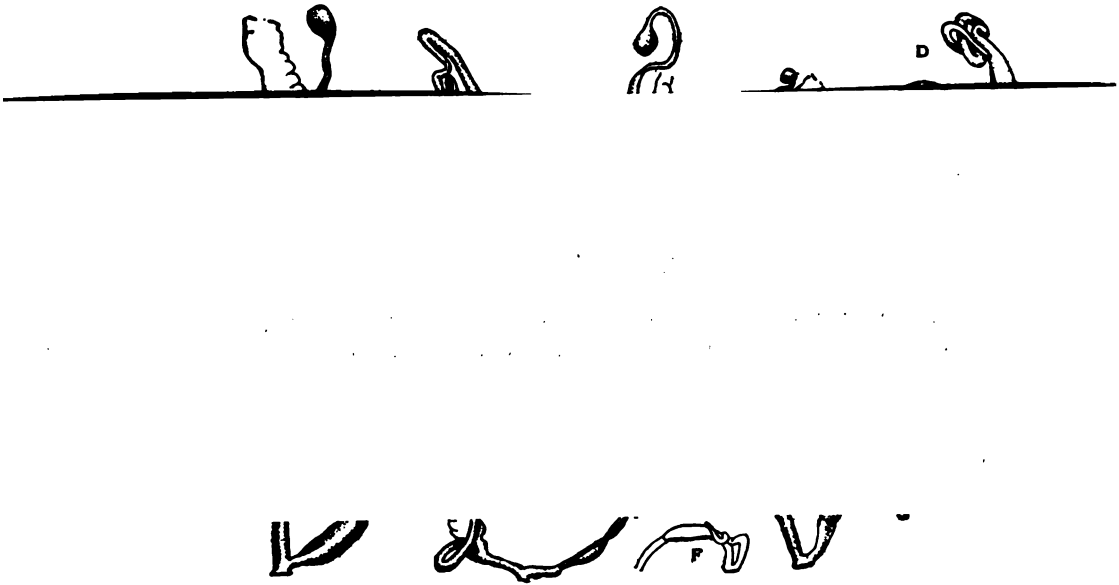


Fig. 5.—A, *Bulimulus a. mariæ*. B, *B. d. liquabilis*. C, *B. d. pecosensis*. D, penis of a fully mature individual of same. E, *B. d. ragsdalei*. F, penis of another individual. G, *B. d. mooreanus*. Fig. D  $\times 2\frac{1}{2}$ ; the other figures  $\times 2$ .

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Devil's river					
<i>B. d. pecosensis</i>	19	11.5	6	20	84,618
	24	1.5			

*B. dealbatus mooreanus* ('W. G. B.,' Pfr.). Pl. VI, figs. 1-6.

Pfr., Monographia Hel. Viv., VI, p. 143 (1868).

*Bulimus schiedeanus* in part, W. G. Binney, Terr. Moll., IV, p. 129, pl. 80, fig. 8.

*Bulimulus schiedeanus* var. *mooreanus* W. G. Binney, Terr. Moll., V, p. 392, figs. 277, 278; Man. Amer. Land Shells, p. 400, figs. 438, 440.

The shell is *thin*, ovate-conic, *opaque white above, coffee-with-cream colored below the periphery*, or sometimes either white or coffee-tinted throughout; sometimes varied with a few gray streaks, or some scattered translucent-gray dots; surface smooth, with the spire more or less *striate*, apical whorls waxen or dark. Umbilicus narrow. Interior cream-white. Five specimens from New Braunfels measure:

Alt.	26	22.5	25.5	23	22.5 mm.
Diam.	16.5	13.5	14	12	13 "
Aperture	15	12.8	12.6	11.8	12.8 "

Distribution, eastern division of the Lower Sonoran in Texas. Originally described from "Washington and DeWitt counties, Texas." Specimens from both of these are before us, and also from Hays, Comal, Guadalupe, Bexar, Medina, Frio, Uvalde and Victoria counties. Some shells from Fort Worth and Waco, in northern Texas, are also like *mooreanus*, while others resemble *B. d. liquabilis*.

*B. d. mooreanus* is smaller, thinner and smoother than the Mexican *B. schiedeanus* (Pfr.), but intergrades with *B. d. liquabilis* Rve. through certain specimens having ragged dark streaks, chiefly on the spire, such as fig. 5 of pl. VI. In the main, the subspecies is quite uniform

in characters, and easily recognized. It is the only *Bulimulus* found in the greater part of the region it inhabits, and is one of the commonest forms in collections.

The specimens seen from Fort Worth are not unlike those referred to *B. d. liquabilis* from Waco, and it is not easy to decide upon which race they belong to. They are undifferentiated forms.

In Comal, Guadalupe, Bexar and Medina counties we found only typical *mooreanus*. In Frio county the shells are somewhat more solid and often whiter. In a series of 313 specimens from along the Guadalupe river above New Braunfels (pl. VI, figs. 2, 3, 4) I could find but one shell with any of the ragged stripes of *B. d. liquabilis*. In 165 taken along the river below San Antonio (pl. VI, fig. 1) there were 7 with some ragged stripes, at least on the upper whorls. A series of 55 *mooreanus* from Victoria had 4 striped shells (pl. VI, figs. 5, 6). The percentage of intergrading specimens is therefore small.

***B. dealbatus liquabilis* (Reeve).** Pl. VI, figs. 7-12.

*Bulimus liquabilis* Reeve, Conch. Icon., V, pl. 57, fig. 387 (Dec., 1848).

*Bulimus confinis* Reeve, Conch. Icon., V, pl. 86, fig. 643 (Feb., 1850).

*Bulimulus schiedeanus* Pfr., W. G. Binney, Terr. Moll., V, p. 391, fig. 276, but not the description.

The shell is thin, variable in shape but usually obese, the aperture half the total length or more. Translucent-corneous or brownish-corneous, more or less profusely marked with opaque whitish ragged streaks. Interior whitish or colored like the outside.

This is the form of the humid Austroriparian zone in Texas, as *B. d. mooreanus* is of the arid division. Specimens are before us from the following counties: Dallas, McLennan, Coryell, Bell, Travis, Lee, Hays, Jackson, Nueces. Also from Limestone Gap, Indian Territory.

Where the range of *liquabilis* adjoins that of *mooreanus* there is a belt of overlapping; but so far as we know the two do not actually occur together. At San Marcos, Hays county, for instance, *B. d. liquabilis* lives on the moist low alluvium along the San Marcos river, while *B. d. mooreanus* is found on the Cretaceous limestone hills above the town. It seems that the one form extends finger-like up some of the streams, while the other may occupy intervening upland or calcareous stations.

*B. liquabilis* and *B. confinis* were both described from "Texas."

*B. d. liquabilis* differs from *mooreanus* by the predominance of corneous-brown coloring. It is also usually more globose and less smooth. It is more globose than *B. dealbatus*, with less convex whorls, as a general rule, yet there seems to be practically complete intergradation between the races, and some Texas shells are not dis-

tinguishable from those of Alabama, though most others could not be matched from east of the Mississippi. On the whole, the race has intimate relations to those east and west of it, yet seems in its own area to be sufficiently differentiated to be recognized.

Specimens from Jackson county (collected by J. D. Mitchell) are typical of *liquabilis*. They are small (pl. VI, figs. 9, 10, 11), well striped as usual, variable in the length of the spire, and generally have a strong, narrow lip-rib.

Alt.	18.7	20.5	18.5	18	21	mm.
Diam.	12	12.5	11	10	12	"
Aperture	11.5	11.5	10	9.5	11.5	"
Whorls	5½	5½	6	6	6½	

Shells from Lee county (J. A. Singley), are larger, more globose, corresponding to Reeve's *B. confinis*. The corneous-brown tint largely predominates over the reduced whitish streaks. Lip-rib present in adults (pl. VI, fig. 12).

Alt.	19	22	25	17.6	mm.
Diam.	14	14	15.2	11.5	"
Aperture	12	13	14.8	10.3	"
Whorls	—	6	6½	6	

Waco specimens mostly have the spire longer, as do those from Belton, Austin and San Marcos. In the series from the latter locality (Ferriss and Pilsbry, 1903) there are about equal numbers of typical striped shells and nearly unicolored corneous-brown ones, with indistinct whitish streaks alternating with pale reddish on the spire (pl. VI, figs. 7, 8). They measure:

Alt.	25.5	25.5	26	mm.
Diam.	14	15	14.5	"
Aperture	14	14	14	"

The genitalia of one of the unicolored shells are figured (fig. B). The individual supplying the preparation was that shown in fig. 7 of plate VI. Fig. 8 of the plate, a streaked shell, was found similar anatomically. Judging by these shells, the race *liquabilis* is quite appreciably different from *mooreanus* in the proportions of the genitalia.

Some specimens from Limestone Gap, Indian Territory, evidently belong to this race.

The shells figured by Binney as *B. schiedeanus* (*Manual of American Land Shells*, p. 399, fig. 437) are apparently *B. d. liquabilis*. They are certainly not the true *schiedeanus*, of which figures may be found in the *Manual of Conchology*.

*Bulimulus dealbatus* (Say). Pl. VI, fig. 13.

*Helix dealbata* Say, Journ. Acad. Nat. Sci. Phila., II, p. 159, 1821.

Say gave the localities "Missouri and Alabama." His specimens in the Academy Museum are labelled Alabama. One of these three, agreeing with the dimensions given by him, is figured (pl. VI, fig. 13), as the type of the species. The Alabama form has a *globose last whorl* and rather large umbilicus. The aperture is a little more than half the total length of the shell, but much less than the diameter of the shell. The shell is profusely striped with ragged white stripes on a pale brownish ground. The type measures, alt. 19.4, diam. 12.2, length of aperture 10.6 mm.

The same form occurs in Tennessee, Kentucky (Warren county), and west to Kansas (Shawnee county). Some specimens from the humid portion of Texas also seem to belong here.

*B. d. ozarkensis* n. subsp. Pl. VI, fig. 14, 15.

*B. dealbatus* Say, Pilsbry, Proc. A. N. S. Phila., 1903, p. 204 (Seligman, Mo.).

On the northern and western borders of the Ozark uplift this form has been differentiated. The whole shell, and especially the last whorl, is narrower, the aperture is smaller, ordinarily half the total length or less, and the umbilicus is narrower. The shape is about that of *B. d. ragsdalei*, but the last whorl is not rib-striate, though the spire is weakly so. Coloration as in *dealbatus*. Specimens measure:

Locality.	Seligman.	Rogers	Mam. Spring.
Alt.	26	21.6	21 mm.
Diam.	13.2	10.5	11 "
Aperture	12.8	10	10.8 "
Whorls	7	7	6½

Limestone Gap, I. T.

Alt.	22	21	20	20	17 mm.
Diam.	11.3	11.2	9.7	10.8	9.4 "
Aperture	11	10.2	9.5	10.8	9 "
Whorls	6½	6½	6½	6½	6

Distribution, northern and western outliers of the Ozark system: Mammoth Spring, Fulton county, Arkansas; Seligman, Barry county, southwestern Missouri (fig. 14); Rogers, Benton county, Arkansas (fig. 15); Limestone Gap, Choctaw Nation, Indian Territory.



While only weakly characterized, this form seems to range over a considerable area, and apparently deserves recognition by name.

*B. dealbatus ragsdalei* (Pils.). Pl. VI, figs. 16, 17.

*Nautilus*, III, p. 122; *Man. of Conch.*, XI, p. 129.

The shell varies from the ovate shape of typical *dealbatus* to a more lengthened and slender form, and is *conspicuously rib-striate*, the striae white on a tawny or white-blotched ground and weaker on the base of the shell. The lip-rib is strongly developed. Three adult specimens of the type lot measure:

Alt.	21.5	18.5	16.5 mm.
Diam.	10.8	10.3	8.3 "
Aperture	10	9.3	8 "
Whorls	6½	6½	6

Only dead, more or less bleached shells have been taken from the top of the Red river bluff at the southern end of Warren's Bend, twenty-five miles northwest of Gainesville, Cooke county, and a mile north of St. Jo, Montague county, Texas.

Across the whole State of Texas nearly 400 miles distant, this form reappears on the Rio Grande river, in Val Verde county, in an area inhabited also by *B. alternatus mariae*. We are quite unable to find any constant differences between these Southwestern shells and the Red river types, although the apparent absence of the form in the intervening territory suggests that the similar forms of the two areas are independent parallel modifications of *dealbatus* stocks, rather than actually connected genetically. Yet it is quite possible that the widely sundered colonies have been or still are connected through the great conchologically unknown area northwest of the oblique line across the State marking the limit of our explorations. Dead, bleached shells were found in abundance on the high land west of Devil's river, but the living ones for some time eluded us. Finally we found them hidden under the dead reversed leaves which thatch the trunks of Yuccas, and sometimes under prostrate dead Yuccas—retreats they share with the smooth race of *Polygyra texasiana* (pl. VI, figs. 18 to 22). The proportions vary a good deal, a series of adult shells measuring:

Alt.	26.5	20	20	21.5	19	16.5	17 mm.
Diam.	12.5	9.2	10.3	10	10.8	10	8 "
Aperture	12.5	9	10	10.5	10.7	9.3	8 "
Whorls	7½	7	6½	6½	6	5½	6½

The average size of 78 living shells is about 19 x 9 to 10 mm. Fig. 18 represents the largest shell taken, a dead one 26.5 mm. long. There is but little variation in sculpture among shells from this place.

Along the Rio San Filipe, not far from the Rio Grande, in chapparal on the east side, we found numerous specimens differing from those of Devil's river by having the rib-striae nearly obsolete on the last whorl except just below the suture. A large number of dead shells were found, but only very few living ones (pl. VI, figs. 23, 24). They have the dull reddish, white-streaked coloration and the shape of the Devil's river *ragsdalei*.

*Bulimulus dealbatus pecosensis* n. subsp. Pl. VI, figs. 26, 27.

*B. d. schiedeanus* var., Pilsbry, Man. of Conch., XI, p. 132, pl. 17, fig. 6.

The shell is *conspicuously calcareous*, whitish with some fleshy or sometimes corneous or ochraceous streaks; upper whorls striate, the last somewhat roughened by irregular growth-wrinkles. Spire long, composed of numerous *short* convex whorls, the suture *nearly horizontal*; apex white or pale; aperture small, usually ochre-tinted in the throat, lip strengthened by a rib within.

Alt.	31	29.7	26.5	24	22.8	21 mm.
Diam.	14.8	14	12.8	12	12.7	10.7 "
Aperture	15	14	12.7	10.3	11.5	10 "
Whorls	7½	7½	7½	7½	7	7

Type locality, on the mesa about 1½ miles southeast of the eastern end of the High Bridge of the Pecos (Southern Pacific Railroad), Val Verde county, Texas. We found one small colony of this form, in the midst of the large dark-mouthed *B. alternatus mariae*, and like that chiefly living on Agave. The extent of the colony was perhaps not more than 50 yards, but as the sun had already set, and we had just emerged from the labyrinthine side canyons of the Pecos, we had time to collect only about thirty-five specimens, each, most of them dead. Everywhere else in the region around the High Bridge we found only *B. a. mariae*.

This form is clearly a stunted race of the larger and less slender *B. schiedeanus* of the Mexican fauna. *B. schiedeanus* has been considered specifically distinct from *dealbatus* by Binney and all the older authorities, as well as by von Martens, who gives a series of good figures in the *Biologia Centrali Americana*; but while the typical *schiedeanus* is distinct enough, there are not lacking specimens suggesting intergradation with some forms of *dealbatus*. If *schiedeanus*

be retained as a distinct species, then the race *pecosensis* will be relegated to it as a variety.

Some specimens of *pecosensis* taken about thirty years ago by Dr. H. C. Wood, probably, as he informs me, from somewhere in the "Great Bend" of the Rio Grande, were noticed in the *Manual of Conchology*, Vol. XI.

*Bulimulus dealbatus pasonis* Pils. Pl. VI, fig. 25.

Pilsbry, *Nautilus*, XVI, July 1902, p. 32.

The shell is smaller and more slender than any other form of *dealbatus*, the diameter about half, the aperture less than half the total length of the shell; nearly smooth, being sculptured with irregular growth-wrinkles only. The dead specimens are dull reddish-corneous with some streaks and mottling of opaque white. Whorls  $5\frac{1}{4}$  to 6, quite convex. Aperture small, ovate, the insertions of the lip and columella markedly approaching, without an internal lip-rib in the specimens seen. Umbilicus comparatively large.

Alt.	15.7	15.3 mm.
Diam.	7.5	7.8 "
Aperture	6.8	6.7 "

Franklin mountain, near El Paso, Texas. (J. H. Ferriss.)

This is the most distinct, as it is the most remote, of the races of *B. dealbatus*, and unless connecting forms come to light, it may well be given specific rank. The absence of regular striation on the spire, the converging ends of the lip and the diminutive size combine to give it individuality. As yet but few specimens have been found, and in a single place. Some individuals of the Val Verde county *B. d. ragsdalei* approach *pasonis* in size, but in a series of about 200 examined none approach the other characters of the present race.

*Bulimulus alternatus mariae* (Albers). Pl. VII.

Die Heliceen, p. 162 (1850).

Binney, *Terr. Moll.*, V, p. 390, figs. 272, 273, pl. li a, upper and lower figs.; pl. li b, all figs.

This species is recognized by its dense, solid, calcareous texture, oblong shape and colored, usually dark brown or purplish interior, and by the great length of the penis and spermathecal duct. Its range extends in a wide belt along the Rio Grande, from the Gulf at least to the Pecos river. How much farther west we do not know.

*B. mariae* was named by Albers for his daughter Mary, having been recognized as distinct on her birthday. The type, figured by Pfeiffer, is a ragged-striped shell with only a low prominence, hardly to be called

a tooth, on the columella. Shells of this exact form and coloring occur at Laredo, Webb county, on the Rio Grande (pl. VII, fig. 28).

In a general way, the eastern (typical) form of *maria* from Frio county and Laredo eastward differs from the western (Val Verde county) form in several respects:

*Southeastern Form.*

Smaller, more oblong; lip more thickened; columella frequently toothed; often with ragged streaks, at least on the earlier whorls. Pl. VII, lower three lines of figures.

*Western Form.*

Larger, more conic; lip less thickened within; no columellar tooth; often streaked, but without ragged or mottled streaks. Pl. VII, upper two lines of figures.

We do not think it advisable at present to make a subspecific separation, especially since none of the names proposed apply to the western race. The genitalia of this race are figured (fig. A).

While almost every colony of the eastern race has slight peculiarities in shape, relative abundance or absence of the several color-forms, etc., yet with large series the intergradation is seen to be so complete that we can find no ground for dividing them into several races, as Prof. Cockerell proposes. His plan (*Journal de Conchyliologie*, 1891, pp. 23, 24) is as follows:

1. With gray or brownish markings:
  - a. Without a columellar tooth, . . . . . *alternatus* Say.
  - b. Columellar tooth present, . . . . . *maria* Alb.
2. Without color markings:
  - a. With no columellar tooth, . . . . . *albidus* Taylor.
  - b. A columellar tooth, . . . *binneyanus* Pfr. MS. W. G. B. [= *intermedius* Singl., Ckll., Corpus Christi.]

The true *B. alternatus* (type in coll. A. N. S.) has not been found north of the Rio Grande, and in all probability does not reach our limits. The name *binneyanus* is preoccupied, so that were the race valid, we should use for that form the name *intermedius* Singl. MS. Ckll., based on Corpus Christi shells. The type locality of *albidus* Taylor MS. Ckll. is Derby, Frio county, Texas.

Many perfectly adult Corpus Christi shells have no columellar tooth, and hence we should have to divide them between *intermedius* and *albidus*. Similarly, various specimens selected from the Derby, Frio county, series before me would be either *alternatus*, *albidus* or *intermedius*; while from the Hidalgo series, all four of the supposed varieties

may be selected. The study of good series of shells taken at random and not selected shows that all lots of streaked shells are more or less mingled with white ones, and in colonies of toothed shells, fully adult and old individuals may be found without a tooth. On the other hand there seem, however, to be colonies without ragged-streaked individuals, and also communities in which no toothed shells are to be found.

Perhaps the colonies containing mottle-streaked or toothed individuals are mixed or hybrid communities. It is a case where experiments on Mendelian lines by some one on the ground might be productive of valuable results.

In illustration of the foregoing remarks, a few of the colonies represented in the collection of the Academy may be noticed in more detail. In studying these races it is absolutely essential that the snails be collected alive. The colors, particularly of the interior, are evanescent and fade quickly on exposure to the sun and weather, though they change very little if at all in the museum.

Corpus Christi, Nueces county (pl. VII, figs. 13, 14, 15, 16), collected by J. A. Singley. Of thick-set compact contour, strong, with a thick cream-tinted lip-rib, which is sometimes brown stained. Pinkish white, almost uniform with some very inconspicuous grayish or fleshy streaks. *Not one in a lot of 43 is marked with brown streaks outside.* Interior varying from *pale yellow* to reddish brown, the darker tint exceptional. Columella varying from strongly toothed to nearly straight. Whorls 6, the earliest post-embryonic not distinctly striated. This form is the "*binneyanus* Pfr." of Binney, *intermedius* Singley MSS. of Cockerell.

Alt.	29	27.3	30	25	23	mm.
Diam.	16	14.5	15	14	12	"
Aperture	16.3	14	15.3	14	11.5	"

At Hidalgo, Hidalgo county (pl. VII, figs. 17, 18, 19), the shells are more slender, white, rarely streaked throughout (fig. 17), but almost all of a series of 41 are variegated on the earlier whorls (fig. 18). Some are strongly toothed, but most shells have no columellar tooth. Interior brown.

Alt.	30	29.5	29	28.5	mm.
Diam.	13.5	13.5	13	14	"
Aperture	14	14.5	13.5	14.5	"

A series from Brownsville consists of similar but less elongated shells.

At Derby, Frio county (pl. VII, figs. 20, 21, 22, 23, 24), the shells are bluish white with bluish streaks, a few brown tinted with brown streaks. The columellar tooth is small or wanting. This form has been called *albidus* Taylor, Ckll.

At Laredo, Webb county (pl. VII, lower line of figs.), the shells are large and mostly long. The lot consists of pure white, and of coffee-tinted, brown-streaked shells, with all intermediate forms. A columellar tooth is exceptionally developed.

At Del Rio, Val Verde county (pl. VII, figs. 9, 10, 11, 12), we found a more conic race. The shells are white, often with some very faint grayish streaks. Interior varying from ochre-yellow to dark brown. In the series of about sixty living shells before us, none has mottled markings, and while in a few there is a weak indication of the columellar tooth, it is as a rule absent. The larger ones measure 29 to 33 mm. long, 16 wide. Some of the dead shells found in the same place are larger, 35 x 18.5 to 37 x 17 mm. A single albino was taken alive (fig. 12). These shells are from the plain along the San Filipe river, on the east side, not far from the Rio Grande. *B. d. ragsdalei* was found in the same place.

On the mesa west of Devil's river we found large dead shells like those from Del Rio but even larger, often with a low lump on the parietal wall, but no tooth on the columella. 39 x 20.5 to 35 x 16 mm.

At the Pecos High Bridge, on agaves, north of the railroad near the eastern end of the bridge, we found *Bulimulus* abundant and finely developed (pl. VII, figs. 1 to 7). The shape varies, but is always more conic than in the eastern localities. It is either nearly uniform white, or coffee-tinted varied with oblique brown or purplish streaks; these two color-forms in about equal numbers, found together on the same plants and connected by intermediate examples. Apex white. The interior is very dark purple-brown. The outer lip is usually but little thickened within, and the columella has no tooth, though often it is slightly salient in the middle. Whorls 7 to 7½.

Alt.	36	37.5	33.3	34.5	36	33.3	37	mm.
Diam.	19	19	17	17	17	16	15	"
Aperture	17.8	17.8	16	16	16	16	14.3	"

The last two measurements show the extremes of shape in a series of 150 living specimens (No. 84,627 A. N. S.).

Another set from east of the Pecos canyon about a mile from the Rio Grande is similar. The largest one measures, alt. 38, diam. 20.3, aperture 19 mm. (pl. VII, fig. 8).

## OLEACINIDÆ.

*Euglandina singleyana* (W. G. Binn.).

*Glandina singleyana* W. G. B., Fourth Supplement Terr. Moll., V, p. 163 (1891).

Singley, Contrib. Nat. Hist. Texas, p. 302.

Sinking Spring, near San Marcos, Hays county, Texas, young specimens only; New Braunfels, Comal county, and its environs; San Antonio, Bexar county; Hondo river drift, near Hondo, Medina county, and in the canyon of the Pecos at High Bridge, Val Verde county. The last locality is the extreme southwestern point known for the species. Mr. Singley reports it also from Guadalupe, Goliad, Gonzales, Travis, Caldwell and Frio counties.

## PUPILLIDÆ.

*Pupilla muscorum* (L.).

Benson, Arizona.

*Pupilla blandi* (Morse).

Texas: Flood débris of Guadalupe river, about four miles above New Braunfels, Comal county.

New Mexico: Pecos river drift at Pecos (Ckl.).

The occurrence of this species near New Braunfels is anomalous; that place lies far below its normal zone, and the shortness of the Guadalupe river precludes the idea that it could have drifted any great distance. Mr. Singley also found one specimen at or near the same place.

*Pupilla hebes* (Anc.).

Proc. A. N. S. Phila., 1900, p. 589, pl. 22, figs. 9, 10.

Huachuca mountains, Cochise county, Arizona. *Two out of about a dozen specimens are sinistral.* They are readily separable from the sinistral *P. syngenes* by the absence of a crest behind the outer lip.

*Pupoides marginatus* (Say).

In Texas we took this species at San Marcos, Hays county; New Braunfels, Comal county; Hondo river, Medina county, and near the Rio Grande at Del Rio, Devil's river four miles from mouth, and drift of Pecos river near High Bridge, Val Verde county.

Arizona: Drift of San Pedro river at Benson.

*Biddaria pellucida hordeacella* (Pils.).

Texas: Drift of Sinking Spring, San Marcos, Hays county; Guadalupe river about four miles above New Braunfels, Comal county; Hondo river, two miles north of Hondo, Medina county; Rio San Felipe near Del Rio, Devil's river near its mouth, and Pecos river near

the High Bridge, all in Val Verde county. Arizona: Benson. New Mexico: Drift of Pecos river at Pecos (Ckll.).

It varies somewhat widely in size, and is found in great quantity in drift débris along all the Texan rivers explored.

***Bifidaria pellucida parvidens* (Sterkl).**

Drift débris of Pecos river at Pecos, New Mexico (Ckll.). This subspecies has not before been reported from so far east.

***Bifidaria procera* (Gld.).**

Texas: Drift of Sinking Spring, San Marcos; Hondo river drift, two miles north of Hondo, Medina county.

The var. *cristata* Pils. and Van. was found copiously in the drift of Guadalupe river, Comal county; near Del Rio; Devil's river; and Pecos river near the High Bridge, Val Verde county. Also Benson, Arizona.

***Bifidaria contracta* (Say).**

Texas: San Marcos; Guadalupe river drift, near New Braunfels; Hondo river, near Hondo; Rio San Filipe near Del Rio; Devil's river; Pecos river near High Bridge. Rather abundant in the river débris except on the Pecos, where but three shells were found. In 1885 Pilsbry took specimens at Galveston.

***Bifidaria armifera* (Say).**

Texas: Drift of Guadalupe river four miles above New Braunfels, Comal county; Pecos river near High Bridge. New Mexico: Pecos, on the Pecos river, collected by T. D. A. Cockerell.

***Bifidaria pentodon* (Say).**

Texas: Sinking Spring, San Marcos, Haÿs county; Hondo river, Medina county.

Vanatta has figured one of the specimens from San Marcos. *Nautilus*, XIX, pl. 6, fig. 11.

***Bifidaria tappaniana* (C. B. Ad.)**

*Pupa pentodon* of authors, not of Sav.

Texas: Guadalupe river about four miles above New Braunfels, Comal county (figured by Vanatta, *Nautilus*, XIX, pl. 6, fig. 12); Hondo river, Medina county; Devil's river, Val Verde county.

***Bifidaria perversa* Sterkl.**

Drift débris of the San Pedro river at Benson, Arizona (Ferriss, 1904). Hitherto known from Nogales, Arizona. (E. H. Ashmun.)

***Bifidaria ashmuni* Sterkl.**

Huachuca mountains, Cochise county, Arizona (J. H. Ferriss.) Also from the following places, collected by E. H. Ashmun. Arizona:



Near Jerome at Mescal Gulch, Walnut Gulch, Page's ranch, Kirwagen's ranch, and drift of Verde river; Navajo Springs; Santa Rita mountains; Oak Creek at Owensby's; drift of Little Colorado river at Holbrook; Nogales, both north and south of the international boundary. New Mexico: Mountain station, Oscura mountains, Socorro county; San Rafael, Valencia county; White Oaks, Lincoln county.

Subgenus CHÆNAXIS nov.

The shell has a large hollow axis, open below, and about one-third the total diameter of the shell, the structure otherwise being like *Bifidaria* s. str.; peristome continuous and free. Type, *B. tuba*.

The Bolivian *Infundibularia infundibuliformis* (Orb.)<sup>9</sup> resembles *B. tuba* in having a very large umbilicus, and we at first thought to associate the Arizonian species with it; but *Infundibularia* differs by the strictly conic shell, and in the aperture, which shows but one lamella, a very large angulo-parietal. Other lamellæ or plicæ, if they exist, must be very deeply immersed, as in the group *Immersidens*.

The type of d'Orbigny's species has been lost, and its internal structure is unknown. It was found with *Bifidaria nodosaria* (Orb.), a minute species, imperfectly described and figured, but probably not distinct from *B. pellucida* (Pfr.).

*Bifidaria tuba* n. sp. Fig. 6.

Shell cylindric with a short apical cone, *openly umbilicate*, the umbilicus nearly one-third the diameter of the shell, penetrating well-like to the apex. Pale brown, smooth, with light growth-lines only. Whorls  $5\frac{1}{2}$ , convex, the apex obtuse; last three whorls forming the cylindrical part of the shell. The last whorl is compressed around the umbilicus, and scarcely straightened in front. The aperture is short-oval, the peristome continuous, thin and well expanded. The angular and parietal lamellæ are combined into one long lamella, notched on the summit; where the two join, the inner end of the angular projects a little on the right side. The columellar lamella is massive, slightly bifid, deeply placed, and enters about as deeply as the parietal. There are small, short, upper and lower palatal and basal folds, in the typical positions, a short distance within the lip, usually with a minute denticle between them, and another at the base.

Length 3, diam. 1.5 mm.

Drift débris of the San Pedro river, Benson, Cochise county, Arizona. Types No. 87,062 A. N. S. Phila.; cotypes in Ferriss collection. A

<sup>9</sup>*Voyage dans l'Amérique Méridionale*, Mollusques, p. 323, pl. 41 bis, fig. 7-10.

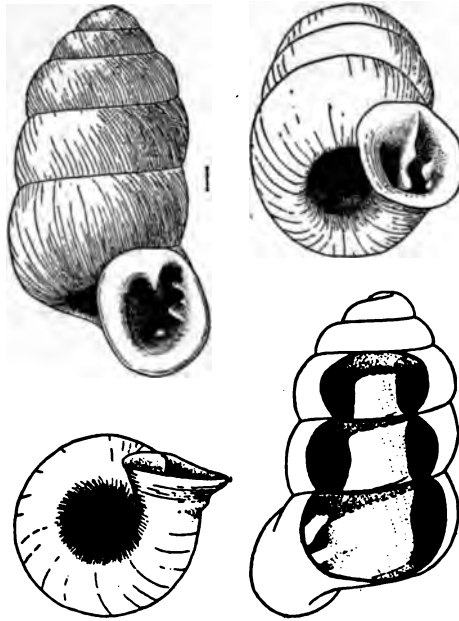


Fig. 6.

single immature specimen was taken by Rev. E. H. Ashmun in drift of the Salt river, at Tempe, Arizona.

Remarkable for its ample umbilicus. The freshest specimens are about the color of *Pupoides marginatus*. None were taken alive. In the adult shell opened (fig. 6) the parietal and columellar lamellæ do not enter deeply, though they go so far that the inner end cannot be seen in the mouth. One broken shell from Tempe, taken by Mr. Ashmun, and which has been in coll. A. N. S. P. for some years, has a strong lamella on the columella, apparently at least a half-whorl long, but not penetrating much farther than fig. 7 shows. This lamella may perhaps be developed during the latter part of the neanic stage, to be resorbed in the fully adult condition. Further material

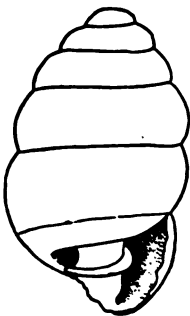


Fig. 7.

is needed to demonstrate this. It is possible that the Tempe shell represents a distinct species. It tapers slightly more than the types from Benson.

***Vertigo ovata* Say.**

Benson, Arizona: Drift of Devil's river, Val Verde county, Texas.

***Vertigo binneyana* Sterki.**

Benson, Arizona (Ferriss).

***Vertigo oscariana* Sterki.**

Drift débris of the Guadalupe river, about four miles above New Braunfels, Texas, a single specimen, a little larger and stronger than Eastern (Austroriparian) examples.

***Vertigo milium* Gld.**

San Marcos, Hays county; Guadalupe river above New Braunfels, Comal county, and on the Hondo river, Medina county, Texas, in flood débris. Only one specimen from each place, among thousands of other *Pupillidae*, etc.

***Strebilops labyrinthica texasiana* n. subsp.**

Shell moderately elevated with dome-shaped spire, brown, whorls  $5\frac{1}{2}$ , the first  $1\frac{1}{2}$  smooth, pale-corneous, the rest regularly ribbed obliquely, the last whorl rounded peripherally or a trifle and obtusely subangular in front, the riblets passing over undiminished upon the base, which is as strongly sculptured as the upper surface (or sometimes smoothish just in front of the aperture). Aperture with expanded, thickened peristome and strong parietal callus, a single strong parietal lamella emerging to the edge of the callus, a second weak one visible within. About half a whorl inward there is a series of about six laminae, the inner one upon the columella, the next short, strong and tongue-shaped, bending outward; the third nearly twice as long, high and sinuous; the fourth very minute and low, often wanting, leaving a space; the fifth and sixth long and low; and just above the periphery on the outer wall a very weak, low, long seventh plica may usually be traced. Umbilicus rather large.

Alt. 1.5, diam. 2.2 mm.

Types No. 91,330 A. N. S. Phila., from drift of the Guadalupe river about four miles above New Braunfels, collected by Pilsbry and Ferriss, 1903. Other localities in Texas are Austin (Pilsbry), San Marcos (Pilsbry and Ferriss), New Braunfels (Ferriss, Pilsbry and Singley), Guadalupe river bottom, Victoria county, and Lavaca river, Jackson county (J. D. Mitchell), Lee county (Singley), Calhoun county (E. W. Hubbard), Gainesville (J. B. Quintard). A smaller form, diam. 2 mm., was taken in drift débris of the Hondo river about two miles north of Hondo, Medina county (Ferriss and Pilsbry). It also ranges northward into Indian Territory and to Kansas.

This form, which for the present we subordinate to the old *S. labyrinthica*, is the only *Strobilops* except *S. hubbardi* which I have seen from Texas. It may be distinguished from *S. virgo* by the costulate base, wider umbilicus and far weaker inner parietal lamella. *S. strebeli* is a much more depressed cone.

The statement by Woodward,<sup>10</sup> copied into American works, that *H. labyrinthica* occurs in pretertiary European strata, is misleading, since the American species is really not identical with any from European strata, though there are numerous allied forms in the European tertiaries. The genus became extinct in Europe, but survives in China, *Helix diodontina* Heude being a *Strobilops*. In America it has not been found in the Northwest or Pacific States, but extends south to Mexico, the West Indies and Venezuela, and a species apparently belonging to the genus has been described from the Galapagos.

#### VALLONIIDÆ.

*Vallonia excentrica* Sterki.

Galveston, under boards in a vacant lot. (Pilsbry, December, 1885.)

*Vallonia perspectiva* Sterki.

Texas: Drift débris of Devil's river, and of Pecos river near the High Bridge, Val Verde county. Arizona: Benson, in drift of San Pedro river.

*Vallonia gracilicosta* Reinh.

New Mexico: Drift of Pecos river, at Pecos (Cockerell!).

*Vallonia cyclophorella* Anc.

Arizona: Drift of San Pedro river, Benson, Cochise county, a single specimen.

#### COCHLICOPIDÆ.

Shell oblong, cylindric-oblong or narrowly tapering, smooth and glossy, with imperforate axis; aperture ovate or acuminate, the columella notched below or continuous with the basal lip. Foot without pedal grooves. Kidney with direct ureter, of the Basommatophorous type. Genitalia with a long appendix on the penis, as in *Achatinella* and the *Pupillidæ*. Jaw and radula about as in *Pupillidæ*.

This group has usually been included in the *Achatinidæ* or *Stenogyridæ*, but the direct ureter removes it to a group of primitive snails represented only by minute species in America, but by the beautiful *Achatinellidæ* and *Partulidæ* in Polynesia. *Cæcilianella* (Cecilioides)

<sup>10</sup> *Manual of the Mollusca*, p. 286, edit. 2, 1868.

belongs to the same family, and probably *Glessula* also, but the pallial organs of that Indian genus are unknown. The group is not related to the *Achatinidae*.

***Cochlicopa lubrica* (Müll.).**

Bear Park and Cave creek canyon, Chiricahua mountains, and Fort Bowie (Ferriss); Carr canyon, Huachuca mountains (Dr. H. Skinner); all in Cochise county, Arizona. Drift débris of Pecos river, Pecos, New Mexico (Ckll.).

**ZONITIDÆ.**

*Omphalina* extends to the western border of the Austroriparian area in Texas. The form taken by us will be discussed in the concluding paper on Southwestern mollusks.

***Zenitoides minuscula* (Binn.).**

Texas: San Marcos, New Braunfels, near Hondo, Del Rio, Devil's river and Pecos river. Everywhere common in drift débris. The specimens all show a tendency to be more widely umbilicate than typical Northern *minuscula*, a large part of them being typical *Z. m. alachuana* (Dall). Those from San Marcos and Comal county are of the size of Northern *minuscula*, but westward the shells reach a decidedly larger size, with the exception of the lot taken at Devil's river, which show but little tendency towards a wide umbilicus.

In Arizona, Ferriss took specimens of var. *alachuana* at Bear Park and Cave creek canyon, Chiricahua mountains, in the drift of San Pedro river at Benson, and in the Huachucas. Like other minutæ, these shells are very rare in the Chiricahua and Huachuca mountains.

*Helix mauriniana* Orb., from Cuba, which has been put in the synonymy of *minuscula*, seems to be a *Thysanophora* close to or identical with *T. saxicola* (Pfr.), as Arango has already stated. *Z. minuscula* occurs also in Japan.

***Zenitoides minuscula neomexicana* Pils and Ckll.**

This form is distinguished by the possession of minute and shallow spiral striation. It seems to be of somewhat common occurrence in New Mexico, and upon examining a set of seven specimens taken by me in Galveston in 1885 I find that they are similarly sculptured. They came from under boards in a lumber yard, and it may be that they were brought from New Mexico with lumber, though I do not know that any lumber was shipped from New Mexico twenty years ago.

**Zonitoides singleyana** (Pils.).

*Zonites singleyanus* Pils., Proc. A. N. S. Phila., 1889, p. 84; 1888, pl. 17, fig. M. (New Braunfels).

*Hyalinia læviuscula* Sterki, Nautilus, VI, p. 53, Sept., 1892 (New Braunfels).

Texas: San Marcos, New Braunfels, Del Rio, Devil's river and Pecos river above the High Bridge; everywhere in river débris.

Arizona: Drift of San Pedro river at Benson.

**Zonitoides nummus** Vanatta.

Proc. A. N. S. Phila., 1899, p. 524, figs. (New Braunfels).

This species seems to be confined to the Texan Lower Sonoran. We took it at San Marcos, Hays county; Guadalupe river above New Braunfels; Hondo river, Medina county; and in Val Verde county near Del Rio; along the Devil's river, and in the Pecos canyon above the High Bridge; everywhere in drift débris.

**Zonitoides arborea** (Say).

Texas: Galveston; Smithville, Bastrop county; Sinking Spring, near San Marcos, Hays county; near New Braunfels, Comal county.

New Mexico: Drift of Pecos river at Pecos (Cockerell).

Arizona: Cave creek canyon and Bear Park, Chiricahua mountains, Cochise county.

**Vitrea indentata** (Say).

Drift of Pecos river, Pecos, New Mexico (Ckll.). As usual, it is the Canadian and Carolinian form of the species which extends down the Rocky mountains into New Mexico, and not the Sonoran subspecies.

**Vitrea indentata umbilicata** ('Singl.', Ckll.).

Ckll., Nautilus, XII, p. 120, Feb., 1899.

Texas: San Marcos, Hays county; around New Braunfels, Comal county; Hondo river two miles north of Hondo, Medina county; Del Rio, Devil's river and Pecos river at the High Bridge, Val Verde county; Alpine, Brewster county,

Arizona: Cave creek canyon and Bear Park, Chiricahua mountains; Fort Bowie. Also Florida mountains, Grant county, New Mexico. Large specimens of this race are probably what has been reported from Texas as *sculptilis* Bld.,—a species which does not, we believe, occur in that State.

This Sonoran race differs from *indentata* by its distinctly perforate axis and larger average size, yet the perforation varies so much in size in specimens from the Carolinian zone that I would not myself have named the Southwestern form. The name is ill-chosen, since the shells are not "umbilicate," as that term is technically used, but "perforate."

*Vitrea hammonis* (Ström).

Drift of the Pecos river at Pecos, New Mexico (Cockerell). The specimens scarcely show a trace of spiral lines. The species is unknown in the Austroriparian and Lower Sonoran zones.

*Vitrea dalliana roemeri* n. subsp. Fig. 8.

Shell openly umbilicate, the width of umbilicus contained about  $4\frac{1}{2}$  times in the diameter of the shell, pale whitish-corneous, in general shape resembling *V. dalliana*, *V. wheatleyi* and *V. petrophila*. Sculpture of *very close and regular radial grooves*, on the last whorl of large specimens becoming crowded and less regular, giving a striate appearance. The flat intervals between the grooves show no spiral striæ. The base is nearly smooth. Whorls  $4\frac{1}{2}$ , but slightly convex, slowly widening, the last about double the width of the preceding. Suture scarcely impressed, translucent-margined below. Base convex. Aperture lunate, slightly oblique; the insertions of the peristome are distant.

Alt. 2, diam. 4 mm.; umbilicus .85 mm.; aperture  $1.7 \times 1.65$  mm.

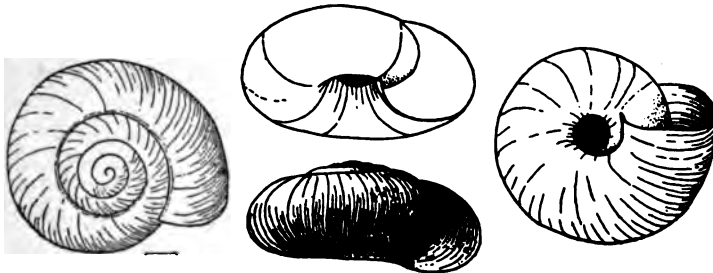


Fig. 8.—*Vitrea dalliana roemeri*.

Sinking Spring creek, near San Marcos, Hays county, Texas. Types No. 91,318, A. N. S. Phila., collected by Pilsbry and Ferriss, 1903. Also taken in several places around New Braunfels, Comal county; in the drift débris of the Hondo river, two miles north of Hondo, Medina county; in drift of the Rio San Filipe near Del Rio, and of the Devil's river, Val Verde county. It has about the distribution of *Holospira goldfussi* and *Helicodiscus eigenmanni*.

This very pretty little species has a slightly more ample umbilicus than *V. wheatleyi* or *petrophila*, and the sculpture is closer and more regular than in either. The last whorl, in dorsal view, is wider than in *V. wheatleyi*. It is much smaller than *V. hammonis*.

*V. dalliana roemeri* attains a larger size than the Floridian *V. dalliana* and the shells have somewhat more regular and crowded grooves on

the last whorl; it is less depressed, and the aperture is perceptibly less broad, more roundly lunate. The differences seem sufficient to call for subspecific separation. The Texan and Floridian areas of distribution seem to be separated, so far as our present data indicates. *V. dalliana* should be looked for along the northern border of the Gulf. It is known now from peninsular Florida only.

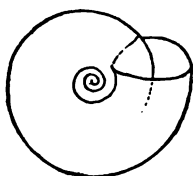


Fig. 9.—*V. dalliana*.

*Vitrea dalliana*<sup>11</sup> and *roemeri* are much smaller than *V. hammonis*, and seem to replace that in the Austroriparian and Lower Sonoran zones. When originally described it was compared with *Zonitoides arborea* (Say), but it is not really related to that but to the *hammonis* group. In fact *V. hammonis*, *binneyana* and *dalliana* form a group of very closely related species. In a large number of *V. dalliana* examined from several localities, the largest shell measures, alt. 1.6, diam. 3.2, width of umbilicus .75, aperture 1.4 mm. wide, 1.2 high. This shell, from Osprey, Manatee county, Fla., is here figured.

The figures do not represent the fine and beautiful sculpture of the surface.

*Vitrea milium meridionalis* n. subsp.

Similar to *V. milium* but larger, diam. about 1.75 mm., with nearly  $3\frac{1}{2}$  whorls, the first one finely, *distinctly lirate spirally*, the last whorl with oblique wrinkles much coarser than in *milium*, more or less anastomosing, and fine spiral striæ, the latter distinct on the base.

*V. milium* with the same number of whorls is smaller and more finely wrinkled, and in Maine and Ohio shells spirals on the first whorl are excessively weak or wanting, not deeply engraved to the tip, as in Texas shells.

Texas: San Marcos, in drift of Sinking creek, in the limestone hills; along the Guadalupe river above New Braunfels (type locality); Hondo river, Medina county; drift of Pecos river. (Pilsbry and Ferriss.)

New Mexico: Cloudcroft, Sacramento mountains (Viereck); Santa Fé (Ashmun).

Arizona: Huachuca mountains (Ferriss); Walnut Gulch near Jerome (Ashmun).

Specimens from Baldwin and Clarke counties, Ala. (C. B. Moore),

<sup>11</sup> *Zonites dallianus* Simpson, Pilsbry, Proc. A. N. S. Phila., 1889, p. 83, pl. 3, figs. 9-11.



seem to be referable to this race. In the Northwest another form of the species, *Z. milium pugetensis* Dall, replaces the typical *milium*. Neither of the subspecies differs much from *milium*, but what differentiation there is seems to be correlated with geographic range.

This species was erroneously placed in *Zonitoides* in the Classified Catalogue of 1898. We are now convinced that it belongs, as Morse demonstrated, to the subgenus *Striatura* of *Vitrea*.

***Vitrea alaskana* Dall.**

*V. pfeifferi* Newc., Proc. Cal. Acad., II, p. 92, 1861; not of Deshayes, 1852.

*Vitrea alaskana* Dall, Land and Fresh-Water Mollusca of Alaska and Adjoining Regions, Harriman Alaska Exped., XIII, p. 37.

Arizona: Huachuca mountains (Ferriss), numerous rather small specimens, the only ones we have seen from Arizona. It seems to be a common species of the Canadian and Transition zones eastward, specimens being before us from the following places in New Mexico: Chichorico canyon near Raton (Cockerell); Las Huastus canyon, Sandia mountains, near Albuquerque (Miss Maud Ellis); near Las Vegas (Miss Mary Cooper); White Oaks and Gilmore's Ranch, Sierra Blanca (Ashmun); Fort Wingate (Dr. E. Palmer); James canyon, Cloudcroft, Sacramento mountains (H. L. Viereck).

The type locality of *V. alaskana* is Carson valley, Nevada; but it has a wide range, from Alaska to the Mexican boundary and probably beyond, southward occurring only at high elevations.

***Eucenulus fulvus* (Müll.).**

Drift of Pecos river, Pecos, New Mexico (Cockerell). Cave creek canyon, Cochise county, Arizona (Ferriss).

***Eucenulus chersinus trochulus* (Reinh.).**

*Nautilus*, XII, p. 116.

Texas: Sinking Spring, San Marcos, Hays county; New Braunfels and vicinity, Comal county; Hondo river, north of Hondo, Medina county; Rio San Felipe near Del Rio, and Devil's river, Val Verde county; everywhere in drift débris.

### ENDODONTIDÆ.

***Pyramidula cronkhitei anthonyi* Pilsbry. n. n.**

*Helix striatella* Anthony, Boston Journ. of Nat. Hist., III, p. 278, pl. 3, fig. 2' 1840. Not *Helix striatella* Rang, 1831.

This shell, well known under the preoccupied name *H. striatella* Anth., has typically a rounded periphery and moderately developed oblique and sigmoid rib-striae, 4 or 5 in the space of a mm. on the front of the last whorl at the periphery. There are  $3\frac{1}{2}$  to  $3\frac{3}{4}$  whorls.

Alt. 2.7, diam. 5.25 mm. Type locality, Fairmount Park, Philadelphia, near "Strawberry Mansion," No. 68,899, A. N. S. P., collected by E. G. Vanatta.

In my opinion the widespread Eastern race is not specifically distinct from *Helix cronkhitei* Newc., of northern California, etc., of which specimens from Dr. Newcomb are before me, but it evidently requires separation as a subspecies.

Arizona: Chiricahua mountains, Cochise county, at Fort Bowie, Bear Park and Cave creek canyon (Ferriss); Carr canyon, Huachuca mountains (H. Skinner).

New Mexico: Drift of Pecos river at Pecos (Ckll.).

Texas: In 1885 I dug a single specimen of this species from the bank of Comal creek, New Braunfels, where it occurred with several other land and fresh-water shells. Singley reports it from the Pleistocene of Swisher county. It is not known to occur living in Texas, or anywhere in the Austroriparian zone. Its occurrence in the Texan Pleistocene is anomalous, like the presence of *Pupilla blandi* at New Braunfels.

#### **RADIODISCUS** Pilsbry, n. gen.

Minute, discoidal, openly umbilicate Patuloid snails with the first  $1\frac{1}{2}$  whorls minutely engraved spirally, the rest of the shell densely radially costulate; aperture lunate, but slightly oblique and as high as wide. Type, *R. millicostatus*.

This genus is proposed for a group of tiny Pyramidula-like snails, various members of which have been found in Arizona, Mexico and South America as far south as Patagonia. In the spiral sculpture of the embryonic whorls these shells are like *Helicodiscus*; in shape and size they resemble *Planogyra*, but in that the embryonic shell is smooth. There are also some similar Polynesian forms, referred to *Charopa*, etc.

In the *Endodontidae*, where small differences in the shell characterize extensive series of species, it seems desirable to recognize as of generic value such readily recognizable groups as *Radiodiscus*. The species are chiefly distinguished by their dimensions and the degree of fineness of the sculpture. There are several undescribed forms in the collection of the Academy.

***Radiodiscus millicostatus* n. sp. Fig. 10.**

Shell very small, disk-shaped, chestnut-brown, the first whorl bluish-white. Whorls  $3\frac{1}{2}$ , slowly widening, separated by a very deep, channelled suture. The first whorl projects a little, and is microscopically striate spirally, the rest of the whorls are radially very densely costulate, the riblets nearly straight, delicate and much narrower than

their intervals, and about 21 in number in a millimeter measured at the periphery, in the front of the last whorl. The last whorl is rounded throughout. The umbilicus is widely open, its width contained about three times in the diameter of the shell. The aperture is slightly oblique and deeply lunate. Alt. 1.1, diam. 2 mm.; diam. of umbilicus .6 to .7 mm.

Huachuca mountains, Cochise county, Arizona, (J. H. Ferriss); Carr canyon (Dr. Henry Skinner). Also in the State of Michoacan, Mexico, at Patzcuaro and Morelia (S. N. Rhoads, 1899).

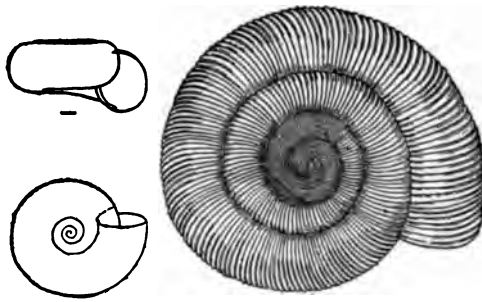


Fig. 10.

This tiny Patuloid, of a group new to our fauna, is one of the most interesting recent finds. It is related to *R. hermanni* (*Helix hermanni* Pfr.), of central and eastern Mexico, but that species is larger and more coarsely sculptured. The two species occur together at the Mexican localities mentioned above, but are readily separable. Dr. Henry Skinner found one broken specimen of *R. millecostatus* in Carr canyon, Huachucas.

Genus **HELICODISCUS** Morse.

This genus has hitherto been considered to include two species, *lineatus* (Say) and *fimbriatus* Wetherby. The accessions of Southwestern material show that several other forms must be recognized. The species are not very conspicuously differentiated, and young shells by themselves are not always readily placed; yet with adults we find no difficulty. The salient characters of the forms follow:

- a.—Diam. of shell 3 to 3.5 mm., whorls 4 to 4½; teeth almost always present. Eastern United States, . . . *H. parallelus* (Say).
- a¹.—Diam. of shell 4.5 to 5 mm., whorls 4½ to 5½; often deficient in teeth.
- b.—Spiral striæ obsolete. Idaho. . . *H. salmonensis* (Hemph.).

- b*<sup>1</sup>.—Spiral striæ well developed, subequal; last whorl not deflexed at aperture.  
*c*.—Umbilicus very wide; last whorl narrow, aperture very small. Arizona and New Mexico,  
*H. e. arizonensis* n. subsp.  
*c*<sup>1</sup>.—Umbilicus smaller, more cup-shaped, last whorl wider. Texas, . . . . . *H. eigenmanni* Pils.  
*b*<sup>2</sup>.—Spirals coarse, some of them more conspicuous, with a cuticular fringe; last whorl in fully adult shells abruptly deflexed in front. East Tennessee, North Georgia, *H. fimbriatus* Weth.

***Helicodiscus parallelus* (Say).** Pl. VIII, figs. 7, 8, 9, 10.

*Helix lineata* Say, Journ. Acad. Nat. Sci. Phila., I, p. 18 (1817); II, p. 373.

Not *Helix lineata* Olivi, Zool. Adriatico, p. 177 (1792).

*Planorbis arallelus* Say, Journ. A. N. S. Phila., II, p. 164, (1821), corrected to *parallelus* in the Index, p. 407. (Upper Missouri.)

*Helicodiscus lineatus* Morse, Journ. Portland Soc., I, p. 25, figs. 61, 62, pl. 2, fig. 3; pl. 7, fig. 63 (1864). Binney, Man. Amer. Land Shells, p. 75.

This common species has been well described by Binney and others. It has ordinarily four whorls, but there may be as many as 4½ in exceptionally large shells. At least one pair of tubercular teeth may be seen in most specimens. Shells of maximum size measure:

Alt. 1.3, diam. 3.5 mm. (Grand Rapids, Mich.)

Alt. 1.25, diam. 3 mm. (Philadelphia.)

The typical form of *H. parallelus* is before me from localities in Ontario, Maine, Massachusetts, Connecticut, New York, New Jersey, Pennsylvania, Maryland, District of Columbia, Virginia, North Carolina, Ohio, Michigan, Minnesota, Indiana, Iowa, Kentucky, Tennessee, Alabama, Florida, Missouri, Kansas, Arkansas, Indian Territory.

I have not seen Texan specimens of typical *lineatus*, but it doubtless occurs in northern and eastern parts of the State.

In New Mexico, at Pecos, Las Vegas, Mesilla, Sandia mountains and other places, and in the Pecos river canyon near its mouth, Val Verde county, Texas, there is a form of *H. parallelus* with rather weak, sparse spirals, the intervals more distinctly striate radially than in typical *parallelus*. This seems to be a form of the southeastern Rocky mountains and southward to the Rio Grande, occupying territory between the ranges of *H. eigenmanni* and *H. arizonensis*, with some overlapping on the territory of the latter.

Say's first name, *Helix lineata*, was preoccupied, but his *Planorbis parallelus* applies to the same species. In the text of the *Journal* the first letter of the name did not print up, but the space in place of it shows that it had been there, and the *p* is correctly supplied in the index. The type used in that volume of the *Journal* was old and full

of "bad letters." All authorities agree that such obvious typographical errors should be corrected.

**Helicodiscus eigenmanni** Pils. Pl. VIII, figs 1, 2, 3.

Nautilus, XIV, p. 41. August, 1900 (Beaver cave, near San Marcos, Texas).

This fine species is easily recognized by its large size, the shell in all stages of growth being very much more robust than *H. parallelus*. It is sculptured with numerous spiral threads as in *H. parallelus*, and when fresh is pale yellow. Alt. 2, diam. 5 mm., with  $5\frac{1}{2}$  whorls.

We took specimens in the drift débris of Sinking creek at San Marcos, Hays county; on the Guadalupe river above New Braunfels, Comal county; on the Hondo river, Medina county, and in the drift of Devil's river, Val Verde county; Alpine, Brewster county. I have seen specimens also from Calhoun county (Hubbard), Lee county (Singley), and Navidad river bottom, Jackson county (J. D. Mitchell). It has not been reported from any place out of Texas, and seems to have about the same distribution as *Holospira goldfussi*.

**Helicodiscus eigenmanni arizonensis** n. subsp. Pl. VIII, figs. 4, 5, 6.

Shell larger than *H. parallelus* with  $4\frac{1}{2}$  to nearly  $5\frac{1}{2}$  whorls, the spire flat or convex, the umbilicus wider than in *parallelus* or *eigenmanni*. Surface closely and strongly lirulate spirally. Aperture oblique, lunate, very small.

Alt. 2, diam. 5 mm., whorls  $5\frac{1}{2}$ . (Fort Bowie.)

Alt. 1.5, diam. 4.6 mm., whorls  $4\frac{1}{2}$ . (Cave creek canyon.)

Arizona: Fort Bowie (type locality); Bear Park and Cave creek canyon, Chiricahua mountains; Huachuca mountains (Ferriss); Santa Rita mountains (Ashmun). New Mexico: Florida mountains, Grant county (Ferriss); Bland, Sandoval county (Ashmun); débris of Arroyo Pecos at Las Vegas (Ckll.).

Readily distinguished from *H. parallelus* when mature by the greater size, with wider umbilicus, more whorls and proportionately smaller mouth. Some specimens are two-toothed. *H. eigenmanni* has a smaller umbilicus, whorls of markedly greater calibre and a larger aperture.

**Helicodiscus salmonensis** (Hemphill).

*Helicodiscus fimbriatus* Wetherby (*salmonacca* Hemphill), W. G. Binney, Third Supplement to Terr. Moll., V, Bull. Mus. Comp. Zool., XIX, No. 4, p. 189 (May, 1890).

*Helicodiscus fimbriatus* var. *salmonensis* Hemphill, in Binney, t. c., p. 220 (May, 1890).

*Helicodiscus fimbriatus* Wetherby, var. *salmonaceus* Hemphill, Binney, Fourth Supplement, Bull. Mus. Comp. Zool., XXII, No. 4, p. 177, pl. 3, fig. 8.

Distinguished by the absence of spiral striæ, according to Hemphill.

I have not seen specimens. Mr. Binney in his first note considers the Salmon river form identical with what Mr. Simpson reported as *H. fimbriatus* from Indian Territory, and gives no separate or definite description of it, though he mentions that Hemphill had given the (MSS.) name "*salmonacea*." The figure of one of the original specimens, given in Binney's Fourth Supplement, represents a shell with wide umbilicus and small aperture, like *H. arizonensis*, from which it differs, according to published information, by the smoother surface, *arizonensis* being constantly very well sculptured.

*Puzosia pygmaea* (Drap.).

San Marcos. Hays county; Comal county; Hondo river, Medina county; Devil's river, Val Verde county.

The form in this region is slightly larger than northeastern specimens, and is more strongly sculptured. There are barely four whorls, the first  $1\frac{1}{2}$  smooth, the next striate; the last two whorls have striae at regular intervals much larger, with about six fine striae in each space, and the basal spirals are very distinct. This sculpture reminds one of the west coast forms, *conspectum*, *pasadenae* and *californicum*, which however are decidedly larger and coarser shells of a dark brown color.

#### SUCCINEIDÆ.

*Succinea luteola* Gold.

Goldf. Proc. Acad. Nat. Sci. Phila., III, p. 37, June, 1848 (Texas); Terr. Moll., II, p. 73, pl. 67c, fig. 1. (Florida; Texas, especially Galveston.)—Binney, Terr. Moll., V, p. 419; Man. Amer. Land Shells, p. 441.

*Succinea texanensis* Pfr., Monogr., II, 526; Roemer's Texas, p. 456, 1849 Galveston.

*Succinea luteola* Sowerby, Conchologia Iconica, XVIII, pl. 10, fig. 67 a, b, 1852 Texas.

We took specimens in Texas along the Guadalupe river above New Braunfels, Comal county; San Antonio, Bexar county; near Hondo river about two miles north of Hondo, Medina county, and in Val Verde county at Del Rio, high land west of Devil's river, and in the canyon of the Pecos near the High Bridge.

In Goldf.'s original description the only locality given was Texas. In the *Terrestrial Mollusks* he states "found in Florida, and more abundantly in Texas, especially in the region of Galveston." Specimens collected at Galveston by the author in 1885 agree perfectly with Goldf.'s figures, and that place may be taken to be the type locality. I have seen no Florida shells which I would refer with certainty to *luteola*, though *S. floridana* is closely related.

*Succinea concordialis* Gld. Figs. 11, 12.

- Gould, in Terr. Moll. U. S., II, p. 82 (Lake Concordia).—Binney, Terr. Moll. U. S., V, p. 419; Man. Amer. Land Shells, p. 441.  
*Succinea forsheyi* Lea, Proc. A. N. S. Phila., 1864, p. 109; Obs. Gen. Unio XI, 134 (Rutersville, Texas).  
*Succinea haleana* Lea, Proc. A. N. S. Phila., 1864, p. 109 (Alexandria, La.).  
*Succinea halei* Lea, Obs., XI, 136 (n. n. for *S. haleana*).

Distribution, Gulf States from Florida to the Rio Grande, on mud or herbage near the water's edge. Common from Louisiana westward, probably rare and local eastward.

The type locality, Lake Concordia, is not in Texas, as Gould and Binney supposed, but in Louisiana. The lake is an abandoned oxbow of the Mississippi river, opposite Naches, Mississippi. Some of Lea's original lot of *S. halei* (*haleana*) before me show that to be merely the young of *concordialis*. *S. forsheyi* Lea, of which two cotypes are in the Philadelphia collection, is surely identical with *concordialis*.

An adequate knowledge of the distribution of *S. concordialis* eastward awaits further exploration of the Gulf coastal penepplain, which in Mississippi, Alabama, Georgia and Florida has been very imperfectly examined for land mollusks. I have not seen *S. wilsoni* Lea, described from Darien, Ga., the figure of which looks a good deal like *concordialis*, though it seems to be less swollen basally. Specimens collected by Mr. A. A. Hinkley at Cypress creek, Ala., in 1895 are evidently *concordialis*; and a set of very pale shells, corneous instead of amber-colored, before me from Mayport, Florida, collected by M. A. Mitchell about twenty years ago, seems to agree with *concordialis* in everything but color. Northward it extends to Frierson (L. S. Frierson) and Bayou Pierre (George Williamson), in northwestern Louisiana, the specimens from these places being rather small. The species must also extend in a long lobe up the Mississippi and its tributaries, for typical specimens have lately been sent by Mr. A. A. Hinkley from Dubois, Illinois, and by Mr. T. Van Hyning from Des Moines, Iowa. Mr. Van Hyning notes that "the animal is black with small yellow dots." These Northern shells may be distinguished from *S. retusa* by their pot-bellied figure and reddish apex.

In Texas, specimens were taken by us in April at San Marcos, Hays county; New Braunfels, Comal county; San Antonio, Bexar county; along the Rio Grande near and San Felipe river, at Del Rio, and along the Devil's river, Val Verde county. We have seen it also from Lee county (Singley) and Spring creek, Victoria county (J. D. Mitchell).

It lives on the moist earth immediately adjacent to the water's edge, and where found is usually abundant. It is a thin shell, rather

deeply amber-colored, with the apical whorls darker, reddish-orange. Whorls  $3\frac{1}{2}$ , the last deeply descending, somewhat flattened above, *very convex basally*, having thus a more sack-like contour than *S. retusa*; this being its chief peculiarity. The sculpture consists of rather coarse wrinkles and often some indistinct spiral impressions on the last whorl. The aperture is symmetrically ovate, the columella concave throughout, with a delicate fold above. Large specimens from San Marcos measure:

Length 16.8, diam. 9, length of aperture 11.5, width 6.7 mm.

Length 16, diam. 8, length of aperture 10.5, width 6 mm.

The mantle is intensely black, dappled throughout in the last whorl with rounded yellowish spots. Those above the kidney are brighter, more conspicuous and usually larger, often more or less confluent.

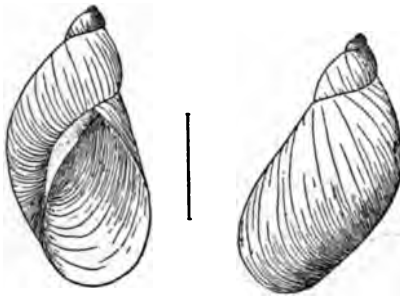


Fig. 11.



Fig. 12.

Towards the edge of the mantle the spots are large and lengthened. The foot including head and eye-stalks is pale grayish-white, speckled with irregular grayish-black spots. The sole is pale yellow. Figs. 11 and 12 were drawn from specimens taken at San Marcos, Texas, near the river.

Specimens from the Rio Grande and Devil's river are of almost as large size; but in some situations it is much smaller, a set from along the San Filipe river at Del Rio measuring, length 12, diam. 6.7, length of aperture 8 mm. Those taken at San Antonio and New Braunfels are also of small size. Such variation in size is apparently not racial, but dependent upon local conditions of the food supply, etc. The color and markings of the mantle are substantially the same in all colonies we found, though there is individual variation in the size of the light spots, figure 12 representing one of the darker individuals.



***Succinea grosvenori* Lea.**

Proc. A. N. S. Phila., 1864, p. 109 (Santa Rita Valley, Kansas?, and Alexandria, Louisiana); Obs. Gen. Unio, etc., XI, p. 135, pl. 24, fig. 108.

*S. mooresiana* Lea, Proc. A. N. S. Phila., 1864, p. 109 (Court House Rock, Platte river, on the California route); Obs., XI, p. 136, pl. 24, fig. 109.

*S. lineata* W. G. Binney, Proc. A. N. S. Phila., 1857, p. 19; Man. Amer. Land Shells, p. 174.

This species is characterized by its very full, rounded whorls and irregular sculpture, often with traces of spiral lines, though as frequently without them. Having part of the original specimens of the above synonyms before us, we are convinced that the three supposed species cannot be separated, although one would hardly expect the same form to range from the lower Mississippi to and throughout the arid great plains and the mountain region of Colorado and New Mexico.

*Succinea greerii* Tryon, described from Vicksburg, Mississippi, is a little less swollen, with the suture not quite so deep, but it is doubtful whether the slight differences shown by the lot of eight specimens will prove constant.

The species belongs to the *campestris* group.

We took a few specimens of *S. grosvenori* at San Antonio, Texas, with *S. concordialis* and a large form of *S. avara*.

***Succinea avara* Say.**

Texas: San Marcos, Hays county; Comal county; San Antonio, Bexar county; Devil's river, Val Verde county. Arizona: Benson, Cochise county.

**AURICULIDÆ.*****Caryohium exile* H. C. Lea.**

San Marcos, Hays county; New Braunfels, Comal county; Hondo river, Medina county, and Devil's river, Val Verde county, Texas. Common in drift débris.

***Caryohium exiguum* (Say).**

Drift of Hondo river, Medina county; of Devil's river, Val Verde county, and of Guadalupe river, Comal county, Texas.

**LYMNÆIDÆ.*****Lymnaea columella* Say.**

New Braunfels, Comal county, Texas. A single slender specimen.

***Lymnaea desidiosa* Say.**

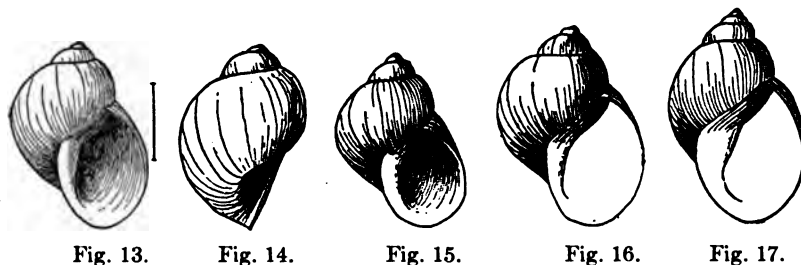
Texas: San Marcos, Hays county; New Braunfels, Comal county; San Antonio, Bexar county; Rio San Filipe, Val Verde county.

***Lymnaea humilis* Say.]**

Guadalupe river, Comal county, Texas.

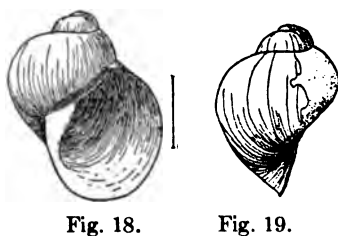
*Lymnaea bulimoides cockerelli* n. subsp. Figs. 13-17.

Shell subglobose, pale yellowish-corneous, composed of  $4\frac{1}{2}$  convex whorls which are finely striate but without spiral lines or malleation. Spire very short, last whorl and aperture very large. Aperture short-ovate, its length three-fifths to two-thirds that of the shell. Columella broadly expanded, not folded. Umbilicus large.



	Las Vegas, N. M.			Arroyo Pecos.		Ogalalla, Neb.			
Alt.	10	8.3	8	8.7	8.5	12	8	9	mm.
Diam.	7.2	6	6.2	6	6	7.8	6	6.6	"
Aperture	6.7	5.3	6	5.7	5	7.5	5.8	6.1	"

New Mexico: Las Vegas (type locality, Miss Mary Cooper), and in the charcoal zone of the Pleistocene of Arroyo Pecos (T. D. A. Cockerell); near Farmington (George H. Pepper); Acama (Dr. E. Palmer). Colorado: Pool southeast of Denver (J. D. Putnam). Nebraska: Ogalalla (C. T. Simpson). Dakota: Lake Hermann (P. C. Truman).



This form differs from *L. bulimoides* and *L. techella* by its more globose shape and shorter spire, and so far as we have seen is readily separable from both. Figs. 13-15 represent the types from Las Vegas; 16, 17 are larger shells from Farmington, sent by Mr. George H. Clapp.

*L. bulimoides sonomaensis* Hemphill, from Sonoma county, California, approaches *cockerelli*, but differs by the more rapidly expanding last

whorl, narrower flat columella and narrower umbilicus, which is like that of typical *bulimoides*. A specimen measures, alt. 10, diam. 7.7, aperture 7.2 mm. (figs. 18, 19).

*Lymanæa bulimoides techella* (Hald.). Figs. 20-23.

*Limnæa techella* Hald., Amer. Journ. of Conch., III, p. 194, pl. 6, fig. 4. (Texas.)

Shell obese, with *acutely conic spire*, of five or six convex whorls; pale yellowish or light brown, finely striate and *usually malleate*, the flattened facets obliquely descending. Last whorl very ventricose, umbilicus large. Aperture short-ovate, about three-fifths the total length; basal lip expanded, *columellar lip broadly dilated*, without a fold. Umbilicus large.



Fig. 20.



Fig. 21.



Fig. 22.



Fig. 23.

	Cotype.	San Marcos, Texas.				Tempe, Ariz.	
Length	8	8.5	11.8	13	14	12.7	12.5 mm.
Diam.	5.1	5.1	7.3	7.6	9	7.8	7 "
Aperture	4.9	5.1	7.3	6.7	8.8	7	6.8 "

In the area under consideration we have seen specimens from the following places:

Texas: Fort Worth (Sampson); Royse, Rockwall county (Ragsdale); Dallas (E. Hall); Houston (Pilsbry); San Marcos, Hays county (Pilsbry and Ferriss); mouth of Nueces river (SINGLEY).

New Mexico: Albuquerque, and McCarty, Valencia county (Ashmun); Rio Grande at Mesilla (Cockerell).

Arizona: Salt river at Tempe (Ashmun).

Other records could probably be supplied from the literature, but it seems usually to have been referred to as *L. bulimoides*. Figs. 20-22 represent specimens from San Marcos, Hays county, Texas; fig. 23 is a more malleate shell from Salt river, Tempe, Arizona.

The young of one season have a comparatively shorter spire than old shells, the rate of descent of the suture progressively increasing somewhat. As usual, there are only traces of malleation at this stage. The erosion of the apices in all but one of the type lot (as mentioned by Haldeman) makes them shorter than they would otherwise be, giving much the appearance of *L. b. cockerelli*. Abundant series from Houston and San Marcos collected by Pilsbry, with others from various naturalists, demonstrate the identity of Haldeman's shells with the larger-spired adult form figured above. *L. techella* was formerly considered by one of us to be a synonym or race of *L. cubensis* Pfr., and *L. bulimoides* was treated as a variety of the same species. They are certainly very similar, but *cubensis* has a more triangular and less broadly developed columellar expansion; and in view of the way *Lymnaea* is being split up into species and races, it may be best to retain the several forms as distinct species or races until the subject can be taken up with ample material and time for the study of Antillean and Mexican forms together with our own.

***Planorbis trivolvis* Say.**

Specimens referable to typical *P. trivolvis* were taken in Comal county, and at Del Rio, Devil's river and the Pecos river, Val Verde county, Texas.

***Planorbis bicarinatus* Say.**

Guadalupe river, Comal county, Texas; abundant and typical.

***Planorbis oarus* n. sp. Pl. IX, figs. 4, 5.**

Shell discoidal, biconcave, the spiral on the left side slightly more sunken and narrower than on the right. Whorls  $3\frac{1}{2}$ , convex, the last round peripherally and on both sides, curving more abruptly into the concavity on the left side. Sculpture of close, very regular obliquely radial rounded striae separated by slightly narrower deep grooves. Pale brown in color. Aperture but slightly oblique, heart-shaped, peristome thin, acute, a trifle dilated at its insertions. Diam. 3.3, alt. (thickness) 1 mm.

"Sinking Spring" near San Marcos, Hays county, Texas; Guadalupe river about four miles above New Braunfels, Comal county. Rio San Filipe and Devil's river, and canyon of the Pecos river about a mile above the High Bridge, Val Verde county; everywhere in drift debris. Types from the last locality.

This little *Planorbis* is very distinct by its beautiful sculpture, constant in numerous specimens from five rivers in central and western Texas. It is much more abundant in the Rio Grande drainage than

in Hays and Comal counties. It is about the size of *P. parvus*, but the aperture is less oblique and the sculpture differs. It was found with *parvus* in Comal county and in the Pecos canyon.

***Planorbis floccinotus* n. sp.** Pl. IX, figs. 1, 2, 3.

Shell very small, biconcave, the spiral narrower and more deeply sunken on the left than on the right side. Whorls about  $2\frac{1}{4}$ , the last broadly rounded peripherally, rounded also on both sides, but less convex on the right than on the left side. Sculpture of inconspicuous growth-lines and numerous *thread-like spiral striae*. Color of bleached specimens white or faintly yellowish. Aperture oblique, heart-shaped, about as long as wide, excised moderately by the preceding whorl.

Greatest diam. of the disk 2.4, alt. (thickness) nearly 1 mm.

San Pedro river, Benson, Arizona, in drift débris. Types collected by J. H. Ferriss, 1904.

This little species may be at once recognized by its spiral striation, which is far stronger than in any other North American species. It is flattened less than *P. parvus*. Only five specimens were taken, but it is so unlike other known Mexican or United States Planorbes that there seems no doubt of its specific distinctness.

***Planorbis parvus* Say.**

Guadalupe river about four miles above New Braunfels, Comal county; Devil's river, Val Verde county, Texas. San Pedro river, Benson, Arizona.

***Planorbis cultratus* Orb.**

Pilsbry, Nautilus, III, p. 63, pl. 1, figs. 1, 2, 3.

This species is thin and delicate, very acutely carinate at the periphery which is close to the left side. In 1889 one of us reported it from Hidalgo, Texas, where it was taken by Mr. Singley. In 1903 we took a single young shell in the drift débris of Devil's river, Val Verde county. The young have a much less acute keel, in fact are angular rather than carinate, and they are less compressed in proportion. *P. cultratus* is found also in Florida (collected at Miami by S. N. Rhoads), Central America and the West Indies. Few of the specimens thus far known from Texas are fully mature or in good condition.

***Planorbis liebmanni* Dkr.**

Canal at New Orleans, Louisiana (H. Hemphill). In Texas at Waco (Hemphill), Austin (E. Hall), San Marcos, New Braunfels, Hondo river, Del Rio, Devil's river and Pecos river (Ferriss and Pilsbry); also in the southeastern part of the state in Victoria county (J. D. Mitchell) and near Brownsville, Cameron county (Clapp). Also in Mexico.

Well-grown specimens have a diameter of 9 to 10 mm., with about 5 whorls.

***Segmentina obstructa* (Morel.).**

Except for the teeth, this species is not distinguishable from *Planorbis liebmanni* Dkr. It does not, however, attain quite so large a size, the largest we have seen measuring slightly less than 9 mm. diameter. The teeth are found in very young shells also; but never more than one set is present at any stage of growth, so far as seen. Specimens are before us from the following places, all in Texas:

Austin (E. Hall); San Marcos, Hays county; New Braunfels, Comal county; Hondo river north of Hondo, Medina county (Pilsbry and Ferriss); Brownsville, Cameron county (sent by G. H. Clapp); Hidalgo, Hidalgo county (Singley); Rio San Filipe, Devil's river and Pecos river, Val Verde county (Ferriss and Pilsbry).

It has also a wide range in Mexico.

The genus *Segmentina* was based upon the European species *S. nitida* Müll. This is a very glossy, flattened shell with acutely angular periphery, simple thin lip, deeply embracing whorls, and barriers composed of three laminae (parietal, basal and upper) transverse to the whorl, leaving a narrow, three-branched space between them.

In eastern Asia a modification of this type is found in such species as *S. largillierti* (Phil.), forming the subgenus *Polypylis* Pils. The shell is less compressed and not carinate, but glossy with deeply clasping whorls. The parietal lamina is obliquely transverse, the others transverse, basal long, a shorter one in the outer wall, and one or two in the upper margin. There are several or many barriers.

The American forms, subgenus *Planorbula* Hald., have less smooth and much less compressed shells, the whorls only slightly clasping, often angular or subangular on the right side but rounded peripherally. There are six laminae: a sigmoid, obliquely entering parietal with a small tubercular denticle near its lower or left end; a transverse basal; an obliquely entering outer lamina with a transverse one above it, and a small entering lamina in the upper margin.

In *S. armigera* the entering lamella in the outer margin curves upward slightly at its inner end. In *S. wheatleyi* all of the laminae are much more strongly developed, and the entering outer one is much longer, running up in a long curve behind the transverse lamina above it. The structures are, however, fundamentally identical in the two species.

In the Antillean and Mexican group to which *S. obstructa* belongs

the whorls are rounded, the parietal laminæ are as in *Planorbula* except that the larger one stands more obliquely, the basal lamina is transverse, but *all the rest on the outer wall are entering plicæ*, the larger lower one curving downward a little at its inner end, not upward as in *armigera* and *wheatleyi*. As in all American forms of the genus only one set of laminæ seems to be present in any individual, though the earliest set is formed at a very early age. In the European and Asiatic species several sets are usually present.

#### PLEUROOERATIDÆ.

*Goniobasis comalensis* Pilsbry. Figs. 24-29.

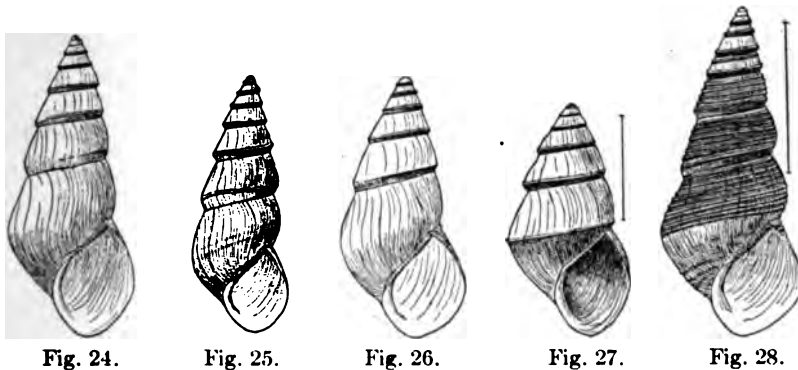
*Melania rufa* Lea?, Römer, Texas, p. 457 ("In den Quellen des Comal-Spring bei New Braunfels sehr häufig").

*Melania pleuristriata* Say, A. G. Weatherby [Wetherby] American Naturalist, April, 1878, p. 254, with var. *marmocki* (springs of southwestern Texas).

*Goniobasis comalensis* Pils., Nautilus, IV, p. 49, Sept., 1890 (Comal creek, New Braunfels).

*G. pleuristriata* Say and *G. comalensis* Pils., Sing. c., Contrib. Nat. Hist. Texas, Geol. Surv. Tex. Ann. Rep., 1892, pp. 311, 312.

Shell conic-turrite, thin but strong, covered with an olive-brown cuticle. Whorls of the spire with a distinct keel which projects a short distance above the suture, and is usually wanting on the last two



whorls; the whole surface showing fine sigmoid growth-striae, and in the best specimens very faint, minute, spiral striae. Aperture ovate, the outer lip thin, sigmoid, retracted below the upper insertion; basal lip rounded or subangular. Columella arcuate, somewhat thickened. Whorls about 7 in the most perfect shells, but usually fewer, the upper ones being eroded.

Length 18, diam. 7.3, aperture 7.3 mm.

Comal creek at New Braunfels, Comal county, Texas. Also in the

Guadalupe river 6 to 4 miles to the north; San Marcos river at San Marcos, Hays county, on the dam above the fish hatchery (Pilsbry and Ferriss; Singley); a variety from Bexar county (A. G. Wetherby).

This form differs from *Melania pluristriata* Say (*M. rubida* Lea) of central Mexico, by its far smaller size and less ample aperture. The type of *pluristriata* measured 1.25 x .55 inches; of *rubida* 1.30 x .57 inches; and the specimens from Lake Chapala examined by Dr. von Martens from 26 x 12 to 35 x 13 mm., while no Texan shell we have seen, in many hundreds examined, reaches 1 inch long. Von Martens refers the Mexican species to *Pachycheilus*. Dr. William H. Dall, to whom we submitted specimens of *G. comalensis* for comparison with the type of *M. rubida* Lea, writes that "though the general form is the same, the *rubida* is very much larger and perfectly distinct." The examples figured are from Comal creek, New Braunfels, near the mill.

The ascertained distribution of *G. comalensis* comprises only the short rivers of a single small system emptying into Espirito Santo Bay, intercalated between the Colorado and Nueces basins, and comprising the Guadalupe and San Antonio rivers and their tributaries.

The Goniobases are known from these streams only at the edge of the "Edwards Plateau." As they live on rocks, etc., in swift water, it is not likely that they approach much nearer to the Gulf. In the



Fig. 29.

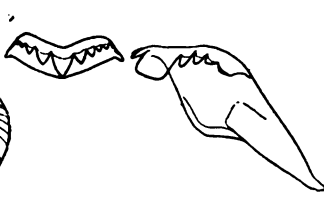


Fig. 30.



Fig. 31.

Colorado river, where Filsbry collected in 1885, nothing was seen of the species, nor has it been reported from the Nueces or its branches. We saw no sign of *Goniobasis* in the tributaries of the Rio Grande, where our collecting was extensive enough to have found it if it existed.<sup>12</sup>

The operculum (fig. 29) consists of about four whorls, the nucleus being situated at about the lower third of its length. It is closely

<sup>12</sup> In the collection of the Academy there are several specimens labelled "Dallas county," received from Mr. J. A. Singley. This is in the Trinity river drainage, but Singley in his catalogue of 1893, issued long after these specimens were placed in the collection, expressly states that he found the species nowhere but in Comal and Hays counties. There was probably some error in labelling the specimens.



marked with growth-wrinkles, and shows some striæ at right angles to them.

The radula (fig. 30) is normal for *Goniobasis*. The central tooth has 4, 1, 4 denticles, the inner lateral 2, 1, 4, inner uncinus 7, outer about 20 denticles. An inner uncinus in profile is drawn on the extreme right side (fig. 31), to show the length of the denticles, which are foreshortened in fig. 30.

*G. comalensis* is dimorphic, like *G. virginica* and many other species. At New Braunfels the smooth form described as typical predominates, but there are also some individuals with numerous acute spiral ridges, about fifteen on the last whorl, but often fewer by suppression of those just below the periphery.

At San Marcos only the smooth phase was found, in several hundred specimens taken.

A series of 12 labelled "Bexar county," received from A. G. Wetherby, consists wholly of multistriate shells, which moreover, although collected alive, are of a whitish or livid whitish tint, in this respect approaching the Mexican *pluristriatus*. The largest of this lot is 23.5 mm. long, 9.3 wide, exceeding in size any seen from Comal or Hays counties. These are part of the lot collected by Mr. G. W. Marmock, of Bexar county, and commented on by Wetherby in the *American Naturalist* for 1878. The "variety *marmocki*" mentioned by him, but without a word of definition, may have been the smooth form of the species, but there is nothing to indicate this either in Wetherby's note or the set of shells he sent to Tryon.<sup>13</sup>

Form *fontinalis*, nov. Figs. 32-35.

In a small spring in the pleasure garden near New Braunfels, one of the fountains of Comal creek, we found only very small shells, the largest 7 to 8.3 mm. long, 4.3 to 4.7 mm. wide, and of a markedly short, conic shape. The old ones are much eroded, and none are of the multistriate phase. This race inhabits only the springs and the rapid streams from them for a short distance down.

In another, much larger spring, and the stream from it for about fifty yards down, the shells are also dwarfs, though somewhat larger than those from the smaller spring.

These springs flow out of the limestone rock, the water being beautifully clear. It is not cold, being perceptibly warmer than the river at the time of our visit, about the middle of April. There is very little vegetation upon the rocks, and the small size of the snails may be due

<sup>13</sup> Mr. Wetherby also mentions that "*Helix photus* Pfr." was collected by Mr. Marmock. This name may be an error for *H. tholus* W. G. B.

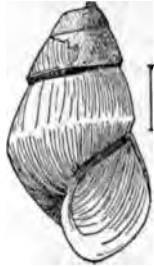


Fig. 32.

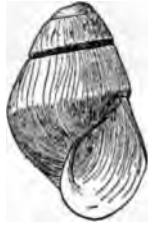


Fig. 33.



Fig. 34.



Fig. 35.

to insufficient food supply. Individuals are, however, very numerous. Associated with them are numerous *Physas*, also of pygmy proportions, though evidently adult. The snails of these springs evidently constitute physiologic rather than morphologic varieties.

#### AMNICOLIDÆ

*Paludestrina seemanni* (F&S.).

New Mexico: South Spring creek, near Roswell, in a Pleistocene deposit (Cockerell and Tinsley, 1899).

Texas: Drift débris of Pecos river, about a mile above the High Bridge, Val Verde county (Pilsbry and Ferriss, 1903).

Dr. R. E. C. Stearns has recorded this species from Death valley, Inyo county, California. The specimens, some of which are before me, are somewhat more robust than those from New Mexico and Texas. The above records largely increase the eastward range of the species.

*Paludestrina diaboli* n. sp. Fig. 36.

Shell very slender, turrit, shaped about like *P. seemanni*; composed of  $4\frac{1}{2}$  very convex whorls separated by a deep suture. Surface smooth. Aperture vertical, oval, a trifle narrower above than below, but not angular there. Peristome continuous, barely in contact with the preceding whorl for a short distance near the upper end. Umbilicus small but distinct.

Length 1.3, diam. .62 mm.



Fig. 36.

Drift débris of the Devil's river, about four miles from its mouth, Val Verde county, Texas. A single shell was also found on the Rio San Felipe near Del Rio, in the same county.

The shells were all taken dead and bleached. It is readily separable from *P. seemanni* by its diminutive size. This is the smallest species of its family known from North America.

*Amnicola comalensis* n. sp. Fig. 37.

Shell distinctly perforate, ovate, thin, corneous, faintly marked with growth-lines. Spire regularly conic, the apex obtuse. Whorls  $4\frac{1}{2}$ , regularly convex, not shouldered, the suture well impressed. Aperture ovate, subangular above, the peristome adnate for a short distance above the perforation.

Length 3.9, diam. 2, length of aperture 1.3 mm.

Comal creek, near New Braunfels, Comal county, Texas. Also from the Guadalupe river about four miles above New Braunfels.

This species is much smaller than *A. limosa*, *decisa*, or other forms resembling it in color and shape. *A. cincinnatiensis* Anth. and the very closely related *A. peracuta* P. and W. both have more shouldered whorls, and are much larger than *A. comalensis*.



Fig. 37.

*Cochliopa riograndensis* n. sp. Pl. IX, figs. 10, 11, 12, 13.

Shell of the usual depressed-turbinate shape, openly umbilicate, of a slightly olivaceous corneous tint. Surface faintly marked with growth-lines, and sculptured with unequal spiral threads, a few of the larger ones dark colored. One thread at the shoulder is usually the most prominent. In some shells the spirals are very weak, hardly perceptible. Whorls  $3\frac{1}{2}$ , moderately convex, flattened and sloping below the suture, elsewhere rounded. Aperture quite oblique, rotundly ovate, the peristome thin, equably arched except near the outer and columellar insertions where it is noticeably straightened. The ends are connected across the parietal wall by a thin or thick callus. The columella is not noticeably thickened.

Alt. 2, diam. 2.8 mm.

Alt. 1.65, diam. 2.65 mm.

Found in drift débris of Rio San Filipe near the Rio Grande, Val Verde county, Texas, thirty-six specimens. Pilsbry and Ferriss, 1903. Types, 91,324, A. N. S. Phila. A single shell was also picked out of similar débris on the Devil's river, about four miles from the Rio Grande, in the same county.

This discovery of this form adds a new genus to the fauna of the United States and greatly extends the distribution of the group, the

other species being Central American.<sup>14</sup> The shell has much the appearance of *Valvata*, but is readily distinguished from that by its ovate, not circular aperture, which is more or less conspicuously angular above, and by having the whorls more compactly coiled. It should, however, be said that we could not verify the generic reference of *C. rogersensis* by examination of the operculum or radula, as unfortunately none of the shells we obtained were living, though some were fresh in appearance, and the operculum was not found. It consists of few whorls in *Cochliopa*, as in *Annicola*, while that of *Valvata* is many-whorled with central nucleus.

*C. rogersensis* is not closely related to any of the known species, being of lighter texture, much more openly umbilicate, and with somewhat different sculpture.

#### VALVATIDÆ.

*Valvata micra* n. sp. Pl. IX, figs. 7, 8, 9.

Shell excessively small, composed of  $2\frac{1}{2}$  tubular whorls; spire nearly flat; the last whorl is nearly round, barely or not quite in contact with the preceding at the aperture, near which it enlarges more rapidly. Suture deep. Surface finely, weakly striate. Aperture moderately oblique, subcircular, the peristome simple, continuous. Umbilicus ample but rapidly narrowing within.

Alt. .48, diam. 1.15 to 1.2 mm.

Drift debris of Guadalupe river about four miles above New Braunfels, collected by Pilsbry and Ferriss, 1903.

This is one of the smallest mollusks known, yet the dilation of the

<sup>14</sup> Prof. von Martens defines four species of *Cochliopa* in the *Biologia Centrali Americana: guatemalensis* Morel., *tryoniana* Pils., *trochulus* and *infundibulum* Mart. (pp. 428, 429). He omits *C. rowelli* Tryon, which was originally described from Clear Lake, California. Rev. J. Rowell, who found the original specimens, now states (*in litt.*) that "*Cochliopa Rowellii* was named from shells collected by me near Baulinas Bay (not Clear Lake), Marin county, California." There are authentic specimens from Central America in the collection of the Academy, so that I still doubt whether the species really was actually collected in California.

Prof. von Martens surmises that *C. guatemalensis* (Morel.), which he had not seen, may not be different specifically from *C. tryoniana*; but it is in fact not even closely related to that species, being very much smaller, more depressed, and evenly sculptured with threadlike spirals. The suture descends shortly in front in fully mature shells. An additional locality is Polvón, in western Nicaragua (McNiel in coll. A. N. S. Phila.). I have examined the radula of *C. guatemalensis* which proves to be Annicoloid, and demonstrates the species to be a *Cochliopa*, not a *Valvata* as Morelet supposed. The central tooth has the formula  $\frac{4.1.4}{3.3}$ , the inner lateral has 6 denticles, the third from the inside being largest, and its body has the usual boss or projection below. The inner uncinus has 13, the outer very many excessively minute denticles.

whorl at the aperture shows it to be adult. Five specimens were taken. The shells are all more or less bleached, the freshest being of a pale corneous tint. The round whorls, deep suture and general appearance are quite unlike any *Planorbis* or *Vallonia*, and indicate, we think, either that it is a *Valvata* or an Amnicoloid snail comparable to *Horatia* Bgt. or *Daudebardiella* Bttg. in the Palæarctic fauna. Until fresh specimens with the soft parts or operculum are found, the position of this molluscan atom will remain uncertain.

*Valvata micra nugax* (pl. IX, fig. 6), a slightly larger form, alt. .9 diam. 1.5 mm., with three whorls and a projecting spire, may prove to be a distinct species; but for the present, until more specimens are found, it may be placed under *V. micra* as a variety or form.

#### CYRENIDÆ.

##### *Pisidium singleyi* Sterki.

Nautilus, XI, 1898, p. 112 (type loc. Guadalupe river, Comal county, Texas).

Drift débris of Guadalupe river about four miles above New Braunfels, and of Devil's river, Val Verde county, Texas. A closely related form was found near Del Rio.

##### *Pisidium compressum* Prime.

New Braunfels, Comal county, Texas. Mr. J. A. Singley found *P. trapezoideum* Sterki at the same place (coll. A. N. S. Phila. No. 60,127).

##### *Pisidium additum huachuacanum* n. subsp.

The shell is quite inflated, dark brownish-olive, irregularly striate and marked with several conspicuous dark growth-arrest streaks; very inequilateral, the beaks low and near the anterior end. Anterior end abruptly truncate, posterior end produced and rounded. Hinge rather narrow, the lateral teeth in the right valve single, short and high, triangular; in the left double. Length 5.1, alt. 4.3, diam. 3.4 mm.

Stream in Carr canyon, Reef, Cochise county, Arizona, collected by C. R. Biedermann, February 8, 1904.

Specimens were submitted to Dr. V. Sterki, who could not identify the form with any known species. About half of the shells are more compressed than those described as typical, one measuring, length 4.1, alt. 3.4, diam. 2 mm. The very inequilateral, anteriorly truncate outline and low beaks are characteristic of both the obese and compressed forms.

##### *Eupera singleyi* (Pils.).

*Sphærium (Limosina) singleyi* Pils., Proc. A. N. S. Phila., 1889, p. 88, pl. 3, figs. 14, 15 (May 14, 1889).

? *Cyclas maculata* Morelet, 1859, not of Anton, 1839 — *Sphærium yacatanense* Fischer and Crosse, Miss. Sci. Mex., Moll., II, p. 653 (1894).

This species is now known to us by specimens from the following

places, all in Texas: White Oak bayou, Houston (Singley); Cedar creek, Hudson county (G. C. Heron, type locality); Lavaca river, Jackson county (J. D. Mitchell); New Braunfels, Comal county (Singley, Ferriss and Pilsbry); Guadalupe river about four miles above New Braunfels (Singley, Ferriss and Pilsbry); Devil's river, Val Verde county (Ferriss and Pilsbry).

It is a prettily maculate little clam, widely distributed in Texan waters. The largest shell I have seen measures 6 mm. long. It may prove to be specifically identical with *E. maculata* Morelet of Yucatan, but that name is preoccupied by Anton for another species of the same group. Both were described as *Cyclus* and belong to *Eupera*. For this reason Crosse and Fischer proposed to substitute the name *yucatanense*; but five years previously I had described and figured *S. singleyi*. The latter name will therefore stand.

#### UNIONIDÆ

A list of species taken by us in Arkansas, Indian Territory and Texas will be published elsewhere. As our work in these States was done in the early spring, we found most of the streams too high for effective collecting of bivalves.

#### EXPLANATION OF PLATES V-LX

- PLATE V.—Figs. 1, 2, 3.—*Physastra maculosa* Swain. W. G. B., Washington twenty, Texas. No. 251. A. N. S. Phila.  
 Figs. 4, 5, 6.—*Physastra maculosa* W. G. B., Guadalupe river, Comal twenty, Texas. No. 91,364. Figs. 8, 9, 10.—Hondo river near Hondo, Texas. No. 91,361.  
 Figs. 11, 12.—*Physastra maculosa* Swain. Pis. Types, Colorado City, Texas. No. 91,358.  
 Figs. 13, 14, 15.—*Physastra maculosa* Swain. Pis. and Ferr. West of Del Rio river, Texas. No. 91,363.  
 Figs. 16, 17, 18.—*Physastra maculosa* Morel., typical. Guadalupe river Comal twenty, Texas. No. 91,362.  
 Figs. 19, 20.—*Physastra maculosa* Morel., Rose with strace base, Calhoun twenty, Texas. No. 259. A. N. S. Phila.  
 PLATE VI.—Figs. 1.—*Physastra maculosa* Swain. W. G. B., San Antonio, Texas. No. 91,359.  
 Figs. 2, 3.—*Physastra maculosa*, Guadalupe river above New Braunfels, Texas. No. 91,360.  
 Figs. 4.—*Physastra maculosa*, Victoria, Texas. No. 91,360.  
 Figs. 5.—*Physastra maculosa*, San Marcos, Texas. Nos. 91,356 and 91,357.  
 Figs. 6.—*Physastra maculosa*, Jackson county, Texas. No. 91,358.  
 Figs. 7.—*Physastra maculosa*, Comal twenty, Texas. No. 91,359.  
 Figs. 8.—*Physastra maculosa*, San Antonio, Texas. No. 91,359. A. N. S. Phila.

- Fig. 14.—*Bulimulus d. ozarkensis* Pils. and Ferr. Seligman, Missouri. No. 83,132.  
 Fig. 15.—*B. d. ozarkensis* Pils. and Ferr. Rogers, Arkansas. No. 91,358.  
 Figs. 16, 17.—*Bulimulus d. ragsdalei* Pils. Types. Montague county, Texas. No. 58,380.  
 Figs. 18, 19, 20, 21, 22.—*B. d. ragsdalei*. Southwestern herd. West of Devil's river, Val Verde county, Texas. Nos. 91,356 and 84,638.  
 Figs. 23, 24.—*B. d. ragsdalei*. Southwestern herd. Del Rio, Texas. Nos. 87,486 and 91,355.  
 Fig. 25.—*Bulimulus d. pasonis* Pils. Type. Near El Paso, Texas. No. 83,259.  
 Figs. 26, 27.—*Bulimulus d. pecosensis* Pils. and Ferr. Near the Pecos river. Nos. 91,359 and 84,618.

PLATE VII.—Varieties of *Bulimulus alternatus mariae* (Alb.).

- Figs. 1-7.—Near the High Bridge of the Pecos. No. 84,627, A. N. S. Phila. Figs. 4 and 5 represent young shells.  
 Fig. 8.—Near the Rio Grande, east of the Pecos river. No. 84,625.  
 Figs. 9, 10, 11.—Near Rio San Felipe below Del Rio. No. 84,635.  
 Fig. 12.—Near Rio San Felipe below Del Rio. An albino, taken alive.  
 Figs. 13, 14, 15, 16.—Corpus Christi, Texas. No. 60,136.  
 Figs. 17, 18, 19.—Hidalgo, Texas. No. 60,094.  
 Figs. 20-24.—Derby, Frio county, Texas. No. 60,501.  
 Figs. 25-30.—Laredo, Webb county, Texas. No. 60,502.

PLATE VIII.—Figs. 1, 2, 3.—*Helicodiscus eigenmanni* Pils. San Marcos, Texas. No. 91,320.

- Figs. 4, 6.—*H. e. arizonensis* Pils. and Ferr. Fort Bowie, Cochise county, Arizona. No. 87,077, A. N. S. Phila.  
 Fig. 5.—*H. e. arizonensis*. A more depressed specimen. Cave Creek Canyon, Chiricahua Mountains. No. 87,076. A. N. S. Phila.  
 Figs. 7, 8, 9, 10.—*Helicodiscus parallelus* (Say). Philadelphia, Pa. No. 78,272, A. N. S. Phila.

PLATE IX.—Figs. 1, 2, 3.—*Planorbis filocinctus* Pils. and Ferr. Type.

- Figs. 4, 5.—*Planorbis carus* Pils. and Ferr. Type.  
 Fig. 6.—*Valvata micra nugax* Pils. and Ferr. Type.  
 Figs. 7, 8, 9.—*Valvata micra* Pils. and Ferr. Type.  
 Figs. 10, 11, 12, 13.—*Cochliopa riograndensis* Pils. and Ferr. Cotypes.

## APRIL 3.

MR. ARTHUR ERWIN BROWN, Vice-President, in the Chair.

Eighty-nine persons present.

The reception of a paper entitled "New, Rare and Little-known Scombridæ, No. 3," by Henry W. Fowler (March 22), was reported by the Publication Committee.

The death of Dr. Ogden Doremus, a correspondent, March 22, was announced.

DR. E. G. CONKLIN made a communication on recent views as to the cause of sex. (No abstract.)

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APRIL 17.

MR. FRANK J. KEELEY in the Chair.

Seventy persons present.

The Publication Committee reported the reception of papers under the following titles:

"Description of a new Australian Glycymeris," by Henry A. Pilsbry (April 10).

"A Monograph of the Genus Collocalia," by Harry C. Oberholser (April 12).

"On Hawaiian Species of Sphyradium," by Henry A. Pilsbry and C. M. Cooke, Jr.

MR. GEORGE VAUX, JR., exhibited a number of beautiful lantern illustrations before the reading of a paper by WILLIAM S. VAUX, JR., giving the results of recent studies of glaciers of the Canadian Rockies and the Selkirks, in continuation of a series of observations extending over a period of eight years. The paper will be published later.

Messrs. Ogilby Paul and Norton Downs, M.D., were elected members.

The following were ordered to be printed,



## A MONOGRAPH OF THE GENUS COLLOCALIA.

BY HARRY C. OBERHOLSER.

There is perhaps no other group of Swifts that equals in general interest the genus *Collocalia*. Some of the species build edible nests wholly or partly of saliva which is secreted in large quantities by salivary glands of unusual size; and the gathering and marketing of these nests has in some places and at some times grown to a traffic of considerable importance.

Owing to the great similarity of many of the species, and the obscurity of the characters separating them, the group is one of the most difficult in the entire family Micropodidæ. Published descriptions,<sup>1</sup> particularly those of the older authors, are often so brief and so lacking in mention of really diagnostic characters that it is hard, sometimes even impossible, to determine with certainty the form intended. Fortunately, perhaps, the sexes, except in a very few cases, are practically identical both in size and coloration. Notwithstanding the fact that some authors have minimized the importance of difference in size,

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<sup>1</sup> The most important papers on the genus are as follows:

- HORSFIELD, T., and MOORE, F.—Genus *Collocalia*. *A Catalogue of the Birds in the Museum of the Hon. East India Company*, I, 1854, pp. 98–106.
- BONAPARTE, C. L.—Note sur les Salanganes et sur leur nids. *Comptes Rendus de l'Académie des Sciences de Paris*, XLI, 1855, pp. 976–979.
- BERNSTEIN, H. A.—Beiträge zur näheren Kenntniss der Gattung *Collocalia* Gr. *Nova Acta Academiæ Leopoldinæ Carolinæ Naturæ Curiosorum*, XXVI, 1, 1857, pp. 13–32.
- BERNSTEIN, H. A.—Ueber die Nester der Salanganen. *Journal für Ornithologie*, 1859, pp. 111–119.
- WALLACE, A. R.—On the Identification of the *Hirundo esculenta* of Linnæus, with a Synopsis of the Described Species of *Collocalia*. *Proceedings of the Zoological Society of London*, 1863, pp. 382–385.
- GRAY, G. R.—A Synopsis of the Species of the Genus *Collocalia*, with Descriptions of New Species. *Annals and Magazine of Natural History*, Series 3, XVII, 1866, pp. 118–128.
- SALVADORI, T.—Osservazioni intorno ad alcune Specie del Genere *Collocalia*, G. R. Gr. *Atti della R. Accademia della Scienze di Torino*, XV, 1879, pp. 343–350.
- HARTERT, E.—*Collocalia*. *Catalogue of the Birds in the British Museum*, XVI, 1892, pp. 496–511.
- HARTERT, E.—Gen. *Collocalia* G. R. Gray. *Das Tierreich*, I, 1897, pp. 66–70.

Guadalupe river 6 to 4 miles to the north; San Marcos river at San Marcos, Hays county, on the dam above the fish hatchery (Pilsbry and Ferriss; Singley); a variety from Bexar county (A. G. Wetherby).

This form differs from *Melania pluristriata* Say (*M. rubida* Lea) of central Mexico, by its far smaller size and less ample aperture. The type of *pluristriata* measured 1.25 x .55 inches; of *rubida* 1.30 x .57 inches; and the specimens from Lake Chapala examined by Dr. von Martens from 26 x 12 to 35 x 13 mm., while no Texan shell we have seen, in many hundreds examined, reaches 1 inch long. Von Martens refers the Mexican species to *Pachycheilus*. Dr. William H. Dall, to whom we submitted specimens of *G. comalensis* for comparison with the type of *M. rubida* Lea, writes that "though the general form is the same, the *rubida* is very much larger and perfectly distinct." The examples figured are from Comal creek, New Braunfels, near the mill.

The ascertained distribution of *G. comalensis* comprises only the short rivers of a single small system emptying into Espirito Santo Bay, intercalated between the Colorado and Nueces basins, and comprising the Guadalupe and San Antonio rivers and their tributaries.

The Goniobases are known from these streams only at the edge of the "Edwards Plateau." As they live on rocks, etc., in swift water, it is not likely that they approach much nearer to the Gulf. In the



Fig. 29.

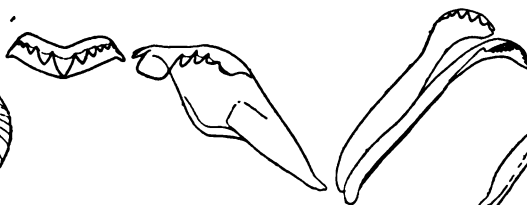


Fig. 30.



Fig. 31.

Colorado river, where Filsbry collected in 1885, nothing was seen of the species, nor has it been reported from the Nueces or its branches. We saw no sign of *Goniobasis* in the tributaries of the Rio Grande, where our collecting was extensive enough to have found it if it existed.<sup>12</sup>

The operculum (fig. 29) consists of about four whorls, the nucleus being situated at about the lower third of its length. It is closely

<sup>12</sup> In the collection of the Academy there are several specimens labelled "Dallas county," received from Mr. J. A. Singley. This is in the Trinity river drainage, but Singley in his catalogue of 1893, issued long after these specimens were placed in the collection, expressly states that he found the species nowhere but in Comal and Hays counties. There was probably some error in labelling the specimens.

marked with growth-wrinkles, and shows some striæ at right angles to them.

The radula (fig. 30) is normal for *Goniobasis*. The central tooth has 4, 1, 4 denticles, the inner lateral 2, 1, 4, inner uncinus 7, outer about 20 denticles. An inner uncinus in profile is drawn on the extreme right side (fig. 31), to show the length of the denticles, which are foreshortened in fig. 30.

*G. comalensis* is dimorphic, like *G. virginica* and many other species. At New Braunfels the smooth form described as typical predominates, but there are also some individuals with numerous acute spiral ridges, about fifteen on the last whorl, but often fewer by suppression of those just below the periphery.

At San Marcos only the smooth phase was found, in several hundred specimens taken.

A series of 12 labelled "Bexar county," received from A. G. Wetherby, consists wholly of multistriate shells, which moreover, although collected alive, are of a whitish or livid whitish tint, in this respect approaching the Mexican *pluristriatus*. The largest of this lot is 23.5 mm. long, 9.3 wide, exceeding in size any seen from Comal or Hays counties. These are part of the lot collected by Mr. G. W. Marmock, of Bexar county, and commented on by Wetherby in the *American Naturalist* for 1878. The "variety *marmocki*" mentioned by him, but without a word of definition, may have been the smooth form of the species, but there is nothing to indicate this either in Wetherby's note or the set of shells he sent to Tryon.<sup>13</sup>

Form *fontinalis*, nov. Figs. 32-35.

In a small spring in the pleasure garden near New Braunfels, one of the fountains of Comal creek, we found only very small shells, the largest 7 to 8.3 mm. long, 4.3 to 4.7 mm. wide, and of a markedly short, conic shape. The old ones are much eroded, and none are of the multistriate phase. This race inhabits only the springs and the rapid streams from them for a short distance down.

In another, much larger spring, and the stream from it for about fifty yards down, the shells are also dwarfs, though somewhat larger than those from the smaller spring.

These springs flow out of the limestone rock, the water being beautifully clear. It is not cold, being perceptibly warmer than the river at the time of our visit, about the middle of April. There is very little vegetation upon the rocks, and the small size of the snails may be due

<sup>13</sup> Mr. Wetherby also mentions that "*Helix pholus* Pfr." was collected by Mr. Marmock. This name may be an error for *H. tholus* W. G. B.

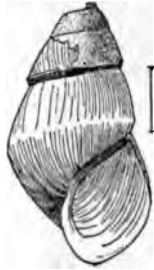


Fig. 32.



Fig 33.



Fig. 34.



Fig. 35.

to insufficient food supply. Individuals are, however, very numerous. Associated with them are numerous *Physas*, also of pygmy proportions, though evidently adult. The snails of these springs evidently constitute physiologic rather than morphologic varieties.

#### AMNICOLIDÆ

##### *Paludestrina seemanni* (Ffd.).

New Mexico: South Spring creek, near Roswell, in a Pleistocene deposit (Cockerell and Tinsley, 1899).

Texas: Drift débris of Pecos river, about a mile above the High Bridge, Val Verde county (Pilsbry and Ferriss, 1903).

Dr. R. E. C. Stearns has recorded this species from Death valley, Inyo county, California. The specimens, some of which are before me, are somewhat more robust than those from New Mexico and Texas. The above records largely increase the eastward range of the species.

##### *Paludestrina diaboli* n. sp. Fig. 36.

Shell very slender, turreted, shaped about like *P. seemanni*; composed of  $4\frac{1}{2}$  very convex whorls separated by a deep suture. Surface smooth. Aperture vertical, oval, a trifle narrower above than below, but not angular there. Peristome continuous, barely in contact with the preceding whorl for a short distance near the upper end. Umbilicus small but distinct.

Length 1.3, diam. .62 mm.



Fig. 36.

Drift débris of the Devil's river, about four miles from its mouth, Val Verde county, Texas. A single shell was also found on the Rio San Filipe near Del Rio, in the same county.

The shells were all taken dead and bleached. It is readily separable from *P. seemanni* by its diminutive size. This is the smallest species of its family known from North America.

***Amnicola comalensis* n. sp. Fig. 37.**

Shell distinctly perforate, ovate, thin, corneous, faintly marked with growth-lines. Spire regularly conic, the apex obtuse. Whorls  $4\frac{1}{2}$ , regularly convex, not shouldered, the suture well impressed. Aperture ovate, subangular above, the peristome adnate for a short distance above the perforation.

Length 3.9, diam. 2, length of aperture 1.3 mm.

Comal creek, near New Braunfels, Comal county, Texas. Also from the Guadalupe river about four miles above New Braunfels.

This species is much smaller than *A. limosa*, *decisa*, or other forms resembling it in color and shape. *A. cincinnatiensis* Anth. and the very closely related *A. peracuta* P. and W. both have more shouldered whorls, and are much larger than *A. comalensis*.

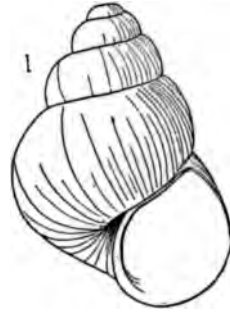


Fig. 37.

***Cochliopa riograndensis* n. sp. Pl. IX, figs. 10, 11, 12, 13.**

Shell of the usual depressed-turbinate shape, openly umbilicate, of a slightly olivaceous corneous tint. Surface faintly marked with growth-lines, and sculptured with unequal spiral threads, a few of the larger ones dark colored. One thread at the shoulder is usually the most prominent. In some shells the spirals are very weak, hardly perceptible. Whorls  $3\frac{1}{2}$ , moderately convex, flattened and sloping below the suture, elsewhere rounded. Aperture quite oblique, rotundly ovate, the peristome thin, equably arched except near the outer and columellar insertions where it is noticeably straightened. The ends are connected across the parietal wall by a thin or thick callus. The columella is not noticeably thickened.

Alt. 2, diam. 2.8 mm.

Alt. 1.65, diam. 2.65 mm.

Found in drift débris of Rio San Filipe near the Rio Grande, Val Verde county, Texas, thirty-six specimens. Pilsbry and Ferriss, 1903. Types, 91,324, A. N. S. Phila. A single shell was also picked out of similar débris on the Devil's river, about four miles from the Rio Grande, in the same county.

This discovery of this form adds a new genus to the fauna of the United States and greatly extends the distribution of the group, the

e<sup>1</sup>.—Wing more than 95 mm.; upper surface much brighter.

[f.—Upper parts much more bluish or purplish.

g.—Larger (wing averaging 104.6 mm.),

*Collocalia linchi cyanoptila*.

g<sup>1</sup>.—Smaller (wing averaging 99.2 mm.),

*Collocalia linchi affinis*.

f<sup>1</sup>.—Upper parts much more greenish.

g.—Larger (wing 103–105 mm.),

*Collocalia linchi linchi*.

g<sup>1</sup>.—Smaller (wing 97–101.5 mm.).

h.—Upper surface duller, somewhat less bluish or purplish; size slightly greater, *Collocalia linchi isonota*.

h<sup>1</sup>.—Upper surface brighter, somewhat more bluish or purplish; size slightly less, *Collocalia linchi elachyptera*.

#### AERODRAMUS,<sup>6</sup> subgenus nov.

*Chars. subgen.*—Similar in proportions to the subgenus *Collocalia*, but tarsus more or less feathered.

*Type.*—*Collocalia innominata* Hume.

*Collocalia leucopygia* Wallace.

*Collocalia leucopygia* Wallace, Proc. Zool. Soc. Lond., 1863, p. 384.

*Chars. sp.*—Upper surface dull, slightly sooty black, with a weak metallic gloss, most evident on crown, the rump with a broad white band whose feathers have conspicuous blackish shaft lines; wings and tail black with some metallic sheen, the latter without white spots; sides of head and neck clove brown, the loreal feathers with white bases; chin and throat brownish gray; remaining lower parts pale grayish anteriorly, becoming brownish on sides of body, and whitish on abdomen, all the feathers with distinct darker shaft lines; longest under tail-coverts glossy blackish brown; thighs and lining of wing brownish black.

Wing, 95–99.5; tail, 45; exposed culmen, 4; tarsus, 8.5 mm.

*Type locality.*—New Caledonia.

*Geographical distribution.*—Loyalty Islands, New Hebrides Islands, and New Caledonia.

This species may readily be distinguished from all its congeners with feathered tarsi, excepting *Collocalia innominata* and *C. agnota*, by the white band on the rump; and from all but *Collocalia agnota* by the

<sup>6</sup> ἀήρ, aer; δραπεῖν, cursare.

whorl at the aperture shows it to be adult. Five specimens were taken. The shells are all more or less bleached, the freshest being of a pale corneous tint. The round whorls, deep suture and general appearance are quite unlike any *Planorbis* or *Vallonia*, and indicate, we think, either that it is a *Valvata* or an Amnicoloid snail comparable to *Horatia* Bgt. or *Daudebardiella* Bttg. in the Palæarctic fauna. Until fresh specimens with the soft parts or operculum are found, the position of this molluscan atom will remain uncertain.

*Valvata micra nugax* (pl. IX, fig. 6), a slightly larger form, alt. .9 diam. 1.5 mm., with three whorls and a projecting spire, may prove to be a distinct species; but for the present, until more specimens are found, it may be placed under *V. micra* as a variety or form.

#### OYRENIDÆ.

##### *Psidium singleyi* Sterki.

Nautilus, XI, 1898, p. 112 (type loc. Guadalupe river, Comal county, Texas).

Drift débris of Guadalupe river about four miles above New Braunfels, and of Devil's river, Val Verde county, Texas. A closely related form was found near Del Rio.

##### *Psidium compressum* Prime.

New Braunfels, Comal county, Texas. Mr. J. A. Singley found *P. trapezoideum* Sterki at the same place (coll. A. N. S. Phila. No. 60,127).

##### *Psidium additum huachuacanum* n. subsp.

The shell is quite inflated, dark brownish-olive, irregularly striate and marked with several conspicuous dark growth-arrest streaks; very inequilateral, the beaks low and near the anterior end. Anterior end abruptly truncate, posterior end produced and rounded. Hinge rather narrow, the lateral teeth in the right valve single, short and high, triangular; in the left double. Length 5.1, alt. 4.3, diam. 3.4 mm.

Stream in Carr canyon, Reef, Cochise county, Arizona, collected by C. R. Biedermann, February 8, 1904.

Specimens were submitted to Dr. V. Sterki, who could not identify the form with any known species. About half of the shells are more compressed than those described as typical, one measuring, length 4.1, alt. 3.4, diam. 2 mm. The very inequilateral, anteriorly truncate outline and low beaks are characteristic of both the obese and compressed forms.

##### *Eupera singleyi* (Pils.).

*Sphærium* (*Limosina*) *singleyi* Pils., Proc. A. N. S. Phila., 1889, p. 88, pl. 3, figs. 14, 15 (May 14, 1889).

? *Cyclas maculata* Morelet, 1859, not of Anton, 1839 = *Sphærium yacatanense* Fischer and Crosse, Miss. Sci. Mex., Moll., II, p. 653 (1894).

This species is now known to us by specimens from the following

entire lower surface dark brownish gray; upper parts more brownish, the light rump band decidedly less conspicuous.

Wing, 130-137; tail, 50-56; exposed culmen, 6; tarsus 12-12.5 mm.

*Type locality*.—Port Mouat, South Andaman Island, Andaman Islands.

*Geographical distribution*.—Southern Tenasserim to Lower Siam and Perak, Malay Peninsula; Mergui Archipelago; accidental(?) on South Andaman Island.

The large size, feathered tarsi, light brownish rump band with dark shaft lines, and the conspicuously darker mesial lines of the lower surface, which last are present in only a few forms of *Collocalia*, sufficiently distinguish this very strongly characterized species. An adult female taken by Dr. W. L. Abbott on September 5, 1896, at Trong, Lower Siam, proves its occurrence in that region.

*Collocalia ocista* sp. nov.

*Chars. sp.*.—Similar to *Collocalia leucophaea*, but tarsi feathered; slightly smaller, except the tail which is longer; upper surface, including wings and tail, darker, more blackish (less brownish), and on head and back as well as elsewhere with a decided greenish metallic gloss; lower parts more grayish.

*Geographical distribution*.—Marquesas and Society Islands.

*Description*.—Type, adult female; Nukahiva Island, Marquesas Islands, September 16, 1899; Charles H. Townsend. Upper surface almost uniform dark sooty brown, slightly deeper on the pileum, a little lighter on the rump—neither of these differences very noticeable—and everywhere with a greenish metallic sheen; wings and tail darker, more blackish, with a bluish or purplish metallic gloss, the wing-coverts slightly more greenish, the innermost secondaries and inner margins of the quills, at least basally, lighter and more brownish—about the same color as the back; sides of head clove brown almost as dark as the crown, the lores quite so, the loreal feathers with lighter brown bases; lower parts nearly uniform deep brownish gray, only the chin and longest under tail-coverts somewhat darker; lining of wing clove brown.

This new and very interesting bird is superficially so much like *Collocalia leucophaea*, with the type of which it has been compared, that a specimen in the Academy of Natural Sciences, Philadelphia, collected long ago in the Marquesas Islands, and presented by Dr. Gambel, was so labelled; but the species may readily be separated by the characters above given. It is fully as dark below as *C. leucophaea*, and like that species is peculiar in possessing light brown bases to the



feathers of the lores. From *Collocalia fuciphaga fuciphaga*, which also to some extent it superficially resembles, it may be distinguished by its larger size and more brownish upper parts, as well as most trenchantly by the light brown instead of pure white bases of the loreal feathers. From *Collocalia fuciphaga elaphra*, a subspecies hereinafter described,<sup>7</sup> with which it agrees in size, and which it more closely approaches in the general color of the upper surface, it differs in being rather more blackish and more uniform above, the rump not so appreciably paler than the back; in having much darker lower surface; also, and most decidedly, in having the bases of the feathers of the lores light brown. This last character alone will separate it from all forms of the genus excepting *C. leucophaea* and *C. thespesia*.<sup>8</sup>

Three specimens of this new species were collected by Mr. Charles H. Townsend in 1899, during his recent Pacific cruise on the U. S. Fish Commission steamer "Albatross." One of these, the single specimen from Tahiti, is rather more brownish above, and a little paler on the crissum than the type, but is very different from *C. leucophaea*; another, from the Marquesas Islands, is more blackish above and slightly darker below; but the old specimen in the collection of the Academy of Natural Sciences of Philadelphia is practically identical with our type.

Measurements of *Collocalia ocista* are as follows:

Sex.	Locality.	Date.	Wing.	Tail.	Exposed Culmen.	Tarsus.
♀	Nukahiva I., Marquesas Islands <sup>9</sup>	Sept. 16, 1899	121	65	5	8.5
—	Nukahiva I., Marquesas Islands	Sept. 15, 1899	119	61	4	9
—	Marquesas Islands		117.5	61	4.5	8.5
♂	Nukahiva I., Marquesas Islands	July 18, 1902	119	61	4.5	9
♂	Tahiti I., Society Islands	Nov. 13, 1899	123	59	4	9
Average			119.9	61.4	4.4	8.8

***Collocalia fuciphaga fuciphaga* (Thunberg).**

*Hirundo fuciphaga* Thunberg, K. Vet. Akad. Nya Handl., XXXIII, 1812, p. 153, pl. 4 (Java).

*Hirundo vanikorensis* Quoy and Gaimard, Voy. Astrolabe, Zool., I, 1830, p. 206, pl. XII, fig. 3 (Vanikoro Island, Santa Cruz Islands, Pacific Ocean).

<sup>7</sup> *Postea*, p. 188.

<sup>8</sup> *Postea*, p. 195.

<sup>9</sup> Type.

*Cotyle vanicorensis* Boie, Isis, 1844, p. 170 (nom. emend. pro *Hirundo vanikorensis* Quoy and Gaimard).

*Hemiprocne salangana* Streubel, Isis, 1848, p. 368 (East Indies).

*Cypselus inquietus* Kittlitz, Denkwurd. Reise, II, 1858, p. 26 (Ualan Island, Caroline Islands, Pacific Ocean).

*Chars. subsp.*—Similar to *Collocalia leucophaea*, but decidedly smaller; tarsus sparsely feathered; bases of the loreal feathers pure white; upper parts very much more blackish, and rather more uniform, the rump not appreciably lighter than the back.

*Type locality.*—Java.

*Geographical distribution.*—East India Islands and western Polynesia, from Nias, Java, Borneo, and the Natuna Islands, northeast to the Philippine, Mariana, and Caroline Islands, east and southeast to New Guinea, Duke of York Island, Tonga (Friendly) and Loyalty Islands.

The birds of a good series, consisting of specimens from Java, the Philippine and Caroline Islands, and from Nias Island, off the western coast of Sumatra, are very uniform in size as well as in the dark lower surface and glossy blackish upper parts, indicating thus that the name *Hirundo vanikorensis* Quoy and Gaimard,<sup>10</sup> which was based on the bird from the Santa Cruz Islands, is synonymous with *Hirundo fuciphaga* Thunberg,<sup>11</sup> from Java. A single specimen from Guam Island is, however, much more brownish above than any of the others examined, and may represent an undescribed race. Much of the difficulty heretofore experienced in identifying this species and in segregating its various forms has arisen from confusing with it the birds with light lower surface and unfeathered tarsi, which occur in various localities, and most if not all of which are *Collocalia unicolor amelis*.

The tail in *Collocalia fuciphaga* is usually quite deeply emarginate, but this character varies greatly. Some specimens in our series have the tail almost even, and there is every gradation evident between this condition and that of greatest emargination, differences apparently to be accounted for only by individual variation. Care must therefore be exercised in using the shape of the tail as an absolute character to distinguish this species.

Measurements of *Collocalia fuciphaga fuciphaga* are as follows:

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<sup>10</sup> *Voy. Astrolabe*, Zool., I, 1830, p. 206, pl. XII, fig. 3.

<sup>11</sup> *K. Vet. Akad. Nya Handl.*, XXXIII, 1812, p. 153, pl. 4.

Sex.	Locality.	Date.	Wing.	Tail.	Exposed Culmen.	Tarsus.
♂	Nias Island.....	Mar. 16, 1903	114.5	54	4.5	8
♀	Mercedes, Mindanao, P. I.	Dec. 19, 1903	114	50	5	10
♀	Pantar, Mindanao, P. I.	Aug. 13, 1903	108	48	4.5	8.5
♂	Java.....		113	51	4.5	9.5
♂	Ualan Island, Caroline Is.	Feb. 8, 1900	114	54	4	9
♂	Ualan Island, Caroline Is.	Feb. 16, 1900	109	54	4	9
Average.....			112.1	51.8	4.4	9

*Collocalia fuciphaga vestita* (Lesson).

*Salangana vestita* Lesson, l'Echo du Monde Savant, ser. 2, VIII, 1843, p. 134.  
*Collocalia nidifica* Gray, Genera Birds, I, 1845, p. 55 (Sumatra).

*Chars. subsp.*—Similar to *Collocalia fuciphaga fuciphaga*, but entire lower surface much paler; upper parts rather lighter and more brownish.

*Type locality.*—Sumatra.

*Geographical distribution.*—Sumatra, Simalur Island, and southern part of Malay Peninsula.

The original *Collocalia fuciphaga* was based on the bird from Java, from which this western form differs as above said. For the latter the name *Salangana vestita* Lesson<sup>12</sup> seems to be available. This is founded on "*Hirundo esculenta* Lath. Gen. Syn. pl. Hab. les fles de la Malasie,"<sup>13</sup> which in both description and locality (Sumatra) is pertinent to the present form. Moreover, the only Sumatran specimen examined agrees with the birds from Simalur Island, upon which latter the present separation is primarily based. The Nias Island bird, however, is identical with that of Java, as already noted, and therefore must be called *Collocalia fuciphaga fuciphaga*. A single adult from Tanjong Silantei, on the east coast of Johore, southern Malay Peninsula, seems to be exactly like the birds from Simalur Island in color, but is considerably larger, the wing measuring 118 mm.; notwithstanding this it seems best referred, for the present at least, to *C. f. vestita*, although additional specimens may show it to be representative of a recognizable subspecies.

Measurements of *Collocalia fuciphaga vestita* are as follows:

<sup>12</sup> l'Echo du Monde Savant, ser. 2, VIII, 1843, p. 134.

<sup>13</sup> Latham, Gen. Synop., Suppl. II, 1801, p. 257, pl. CXXXV.

Sex.	Locality.	Date.	Wing.	Tail.	Exposed Culmen.	Tarsus.*
♂	Tanjong Silantei, E. Coast					
	Johore.....	July 26, 1901	118	51	5	9
♂	Simalur Island.....	Dec. 7, 1901	111	51	5	9
♂	Simalur Island.....	Dec. 7, 1901	112.5	48	4.5	9
—	Sumatra.....		115	52	4	9.5
	Average.....		114.1	50.5	4.6	9.1

*Collocalia fuciphaga elaphra* subsp. nov.

*Chars. subsp.*.—Similar to *Collocalia fuciphaga fuciphaga*, but decidedly larger; upper parts much more brownish, and less uniform, the rump being noticeably lighter than the back; lower surface decidedly paler.

*Geographical distribution.*.—Seychelles Islands; Anamba Islands.

*Description.*.—Type, adult, sex unknown, No. 119,779, U. S. N. M.; Mahé Island, Seychelles Islands, April 17, 1890; Dr. W. L. Abbott. Upper surface sooty brown, with a very slight greenish gloss, the pileum rather darker and more greenish, the rump much lighter brownish—but not whitish—this due partially to the lighter bases of the feathers; wings and tail darker, more blackish, with a dull bluish, greenish or purplish sheen, the wing-coverts decidedly greenish; sides of head and neck dark brown, darkest on the lores, where the feathers have pure white bases; entire lower surface rather deep brownish gray, somewhat paler posteriorly, darker on chin, the longest under tail-coverts slightly glossed with greenish; lining of wing blackish brown.

The specimens on which this race is principally established were collected by Dr. W. L. Abbott on Mahé, one of the Seychelles Islands. They differ so much from typical *Collocalia fuciphaga*, of which we have a considerable series from several localities, that it seems necessary to regard them as representatives of another subspecies.

The lighter colored rump, which seems to be one of the best characters of this race, is not sufficiently decided to give the impression of a whitish band such as exists in *Collocalia francica* and its allies, but it is nevertheless quite different from the uniformly dark condition obtaining on the upper surface of *Collocalia fuciphaga fuciphaga*. From *Collocalia fuciphaga vestita*, which in some respects it resembles more closely than it does true *fuciphaga*, it may readily be distinguished by its greater size, lighter, more brownish, and less uniform upper surface, with the rump noticeably paler than the back. This new race, how-

ever, does not need special comparison with any further forms of the genus, even those possessing feathered tarsi.

Two adults from Pulo Jimaja, Anamba Islands, are somewhat less brownish above, as well as very slightly darker below, but nevertheless agree in all details of coloration quite closely with the birds from the Seychelles Islands, and differ thus quite remarkably from *Collocalia fuciphaga fuciphaga*, by whose range the Anamba Islands are pretty well surrounded. In all measurements excepting that of the wing these two specimens exceed the measurements of *fuciphaga* and equal or even surpass those of *elaphra*; but the wing-quills are molting and not fully grown, and there are indications from the relative length of the primaries that the length of the wing would have become when perfect almost if not quite as great as that of *elaphra*. In light of present knowledge, therefore, it seems best to refer to *elaphra*, with the above explanation, these two examples from the Anamba Islands, even though by so doing *elaphra* presents an anomalous geographical distribution. Should, however, a satisfactory series show the Anamba bird to be really much smaller than that from the Seychelles Islands, and reasonably constant in its slight color differences, it ought probably to be separated subspecifically.

Measurements of two adults of *Collocalia fuciphaga elaphra* are here given:

Sex.	Locality.	Date.	Wing.	Tail.	Exposed Culmen.	Tarsus.
♀	Mahé I., Seychelles Is. ....	April 17, 1890	120.5	51	4.5	9
?	Mahé I., Seychelles Is. <sup>14</sup> ..	April 17, 1890	121	51	4	9.5
Average.....			120.8	51	4.3	9.3

*Collocalia brevirostris* (McClelland).

*Hirundo brevirostris* McClelland, Proc. Zool. Soc. Lond., 1839, p. 155.

*Chars. sp.*—Similar to *Collocalia fuciphaga fuciphaga*, but much larger; tail less deeply emarginate; and rump noticeably lighter than the very dark back.

Wing, 124–127; tail, 55–59; exposed culmen, 5.5; tarsus, 10 mm.

*Type locality.*—Assam.

*Geographical distribution.*—Himalaya Mountains from Dalhousie, about 76° east longitude, east through Nepal and Sikhim to Assam and Manipur.

This form has been until comparatively recent years usually consid-

<sup>14</sup> Type.

ered identical with *Collocalia unicolor*, from which, however, it may readily be distinguished by its feathered tarsi, darker, less brownish upper surface, with rump appreciably lighter than the back. It is most closely allied to *Collocalia fuciphaga*, and by Dr. Hartert is considered a subspecies of this; but its large size and other characters, combined with its isolated range, so far as *C. fuciphaga* is concerned, quite clearly indicate its specific distinctness. Furthermore, there is, so far as is known at present, no intergradation in size between *Collocalia brevirostris* and any form of *Collocalia fuciphaga*; and the race of the latter, *C. f. elaphra*, which is nearest in size is most different in color. The so-called intermediate specimens from the western Himalayas, mentioned by Dr. Hartert,<sup>15</sup> have proved to be examples of *Collocalia unicolor*, a form belonging to the group without feathers on the tarsus, and have thus no bearing on the question. Therefore, until actual proof of intergradation with *Collocalia fuciphaga* be forthcoming, the present form should stand as a full species.

***Collocalia lowi* (Sharpe).**

*Cypselus lowi* Sharpe, Proc. Zool. Soc. Lond., 1879, p. 333.

*Cypselus labuanensis* ———, Ibis, 1879, p. 116, in text (*nomen nudum*).

*Chars. sp.*—Like *Collocalia innominata*, but rump without a well-defined light band.

Wing, 127–134; tail, 50–57; exposed culmen, 5; tarsus, 10–12 mm.

*Type locality.*—Labuan Island, northern Borneo.

*Geographical distribution.*—Northern Borneo; Palawan Island, Philippine Islands; Anamba Islands; accidental in Sumatra and on Nias Island (Hartert).

This species resembles *Collocalia leucopygia* and *Collocalia innominata* in possessing dark shaft lines on the lower surface, and in this it differs with them from all the other members of the subgenus. In color above and below—except for the lack of a light rump band—as well as in size and proportions, it is identical with *Collocalia innominata*. It is so much larger, and usually has the tail so much less deeply emarginate, than *Collocalia fuciphaga* and all subspecies of the latter that further comparison is unnecessary. One specimen in the United States National Museum has the tail by no means square, but considerably emarginated, from which it is evident that there is considerable individual variation in this regard.

Subgenus COLLOCALIA Gray.

*Chars. subgen.*—Tarsus entirely without feathers.

*Type.*—*Hirundo esculenta* Linnæus.

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<sup>15</sup> *Cat. Birds Brit. Mus.*, XVI, 1892, p. 502.

*Collocalia origenis* sp. nov.

*Chars. sp.*—Resembling *Collocalia whiteheadi*, but upper parts much darker, more blackish, and more uniform, the rump not appreciably lighter than the back; under surface darker, and throat not decidedly paler than abdomen.

*Geographical distribution.*—Mindanao, Philippine Islands.

*Description.*—Type, adult male, No. 192,162 U. S. N. M.; Mount Apo, 4,000 feet, Mindanao, Philippine Islands, July 4, 1904; Dr. E. A. Mearns. Upper surface uniform brownish black, the rump not lighter, but wings and the distinctly forked tail more brownish, their feathers paler along the inner margins; entire ventral surface uniform smoky hair brown, the throat not paler; sides of head and neck darker brown than the under parts; a blackish spot in front of the eye; lining of wing blackish brown.

This new species was discovered by Dr. Mearns during his recent trip to the island of Mindanao, the four adults obtained having been brought by natives who had found them in a cave on Mount Apo; and we are indebted to him for the privilege of describing them.

In its large size, deeply emarginate tail, and lack of tarsal feathering *Collocalia origenis* agrees with *Collocalia whiteheadi*, but is readily distinguishable by the dark colors, particularly on the upper parts which are even more blackish than in *Collocalia fuciphaga fuciphaga* from the Philippines. There is a slight sexual difference in this species, apparent in our series of two adult males and two adult females, but it is possibly not constantly distinctive: the females are somewhat more brownish above, and slightly paler below. A very young bird, with wings and tail but little grown, taken by Dr. Mearns, July 11, 1904, at Todaya, altitude 4,000 feet, on Mount Apo, is fully as blackish on the upper parts as the adults, and somewhat darker, decidedly more grayish on the ventral surface.

Measurements of the adults are as follows:

Ser.	Locality.	Date.	Wing.	Tail.	Exposed Culmen.	Tarsus.
10007	Mt. Apo, Mindanao, P. I.	July 4, 1904	129	53	6	13
	" " "	"	138	60	5.5	14
	" " "	"	134	51	5.5	12.5
	" " "	"	130	54	5.5	14
Average.....			132.8	54.5	5.6	13.4

<sup>11</sup> Type.

***Collocalia whiteheadi* Grant.**

*Collocalia whiteheadi* Grant, Ibis, 1895, p. 459.

*Chars. sp.*—Similar in color to *Collocalia lowi*, but dark shaft streaks on lower parts less distinct; averaging slightly larger, with unfeathered tarsi, and usually more deeply emarginate tail.

Wing, 127–140; tail, 50–57; exposed culmen, 5; tarsus, 11.5–13 mm.

*Type locality.*—Monte Data, highlands of Lepanto, northern Luzon, Philippine Islands.

*Geographical distribution.*—Islands of Luzon and Palawan, Philippine Islands.

This very distinct species may be easily distinguished from all the others with unfeathered tarsi, excepting *Collocalia origenis*, by its very large size, and from that form by the well-marked color characters already detailed. Specimens from Palawan are smaller than those from Luzon, touching the minimum of measurements above given, and also appear to be more brownish on the upper parts—differences which, should they prove reasonably constant, would entitle the Palawan bird to subspecific rank.

***Collocalia unicolor unicolor* (Jerdon).**

*Hirundo unicolor* Jerdon, Madras Journ., XI, 1840, p. 238.

*Cypselus concolor* Blyth, Journ. As. Soc. Bengal, XI, pt. 2, 1842, p. 886 (nom. nov. pro *Hirundo unicolor* Jerdon).

*Chars. subsp.*—Resembling *Collocalia whiteheadi*, but much smaller; more brownish and more uniform above, the rump not appreciably paler than the back, the pileum but little if any darker; lower surface rather more brownish and more uniform, the throat usually not lighter than the abdomen; lining of wing lighter.

Wing, 112–120.5; tail, 50–56; exposed culmen, 4–4.5; tarsus, 9–10 mm.

*Type locality.*—Coonoor Pass, Nilghiri Hills, southern India.

*Geographical distribution.*—Ceylon; and the western coast region of southern India, north to Vengurla; western Himalayas.

Although this species has commonly been either synonymized with *Collocalia fuciphaga* or treated as a subspecies of it, the entirely unfeathered tarsi are a character fully sufficient for specific recognition; and furthermore the upper surface is more brownish than in even the least blackish forms of *Collocalia fuciphaga*. In fact *Collocalia unicolor* is really more closely allied to *Collocalia whiteheadi* than to *Collocalia fuciphaga*! Dr. Hartert has given<sup>1</sup> as a reason for considering *C. unicolor* a subspecies of *C. fuciphaga* that some Celebes birds similar to *C. unicolor* in color, which he refers to *C. fuciphaga*, have no tarsal

<sup>1</sup> Ibis, 1896, p. 369



feathers; but these have hardly bearing on the question, for they without much doubt belong to *Collocalia unicolor amelis*. The present form is said to occur in the western Himalaya Mountains, but careful comparison of a satisfactory series from this locality with typical examples from southern India would possibly show subspecific differences. Immature birds of *Collocalia unicolor* are rather darker, more sooty than adults, both above and below.

*Collocalia unicolor amelis* subsp. nov.

*Chars. subsp.*—Similar to *Collocalia unicolor unicolor*, but less brownish and less uniform above, the rump usually appreciably paler than the back, the pileum decidedly darker; lower surface rather less brownish and less uniform, the throat usually decidedly lighter than the abdomen; lining of wing darker; tail usually rather less deeply emarginate.

*Geographical distribution.*—Philippine Islands; Island of Guam; ? Celebes; ? Louisiade Archipelago.

*Description.*—Type, adult male, No. 189,931 U. S. N. M.; Irian, Benguet, Luzon, Philippine Islands, May 19, 1903; R. C. McGregor and A. Celestino. Upper parts dark sooty brown with a greenish tinge and but little gloss, the head darker, the rump slightly paler; wings and tail darker than the back—blackish brown with a greenish sheen, the inner webs of the wing-quills dull and paler brown; lower surface grayish brown, darkest on the lower tail-coverts, palest on the throat and jugulum; lining of wing blackish brown. "Iris brown, bill and claws black; legs dark reddish brown."

Several specimens of this new form, identified as *Collocalia whiteheadi*, were some time since received from the Philippine Museum by the U. S. National Museum. Notwithstanding the similarity of proportions (including the forking of the tail), the very great difference in size renders it easily distinguishable from *C. whiteheadi* on even superficial examination. From *Collocalia francica* and other light-rumped species *Collocalia unicolor amelis* is at once to be separated by its lack of the whitish band on the rump. Its nearest relative is, of course, *Collocalia unicolor unicolor* of southern India, from which, though similar in size, it differs as above mentioned; but comparison of a series of each of these forms shows none of the characters to be quite constant, hence *amelis* must rank as a subspecies. The tarsi in *C. u. amelis* are entirely devoid of feathers, therefore no special comparison is really necessary with *Collocalia fuciphaga* and its allies, except for specimens of *fuciphaga* that have accidentally lost the tarsal

feathering. In color *C. u. amelis* differs from *C. fuciphaga fuciphaga* by reason of paler ventral surface, particularly the throat, and more brownish upper parts, with lighter rump. It is paler, more brownish above than *C. f. vestita*, with the rump noticeably lighter than the back. Compared with *C. f. elaphra* it has the upper parts less brownish, the crown particularly more blackish, the rump less different from the back; lower surface less uniform, the posterior portion darker; and size somewhat less.

The small Celebes birds without tarsal feathering, mentioned by Mr. Grant,<sup>18</sup> belong probably to this subspecies, for they are evidently not *Collocalia fuciphaga*. Also the birds from St. Aigan Island, in the Louisiade Archipelago, said by Dr. Hartert<sup>19</sup> to be light below, to have unfeathered tarsi, and to build nests different from *C. fuciphaga*, are probably to be referred to *C. u. amelis*, though possibly subspecifically distinct. Aside from the above, *Collocalia u. amelis* is not at present certainly known except from the Island of Guam, where taken by Dr. E. A. Mearns, July 20, 1905, and from the Philippine archipelago, where it has been obtained on the Islands of Luzon, Verde, Cagayancillo, Sibuyan, Panay, Mindoro, Mindanao, and Palawan. It may, however, be quite generally distributed over the East India Islands, and may have been recorded as *Collocalia fuciphaga* from various localities, since hitherto it seems to have been confused with that species, because its unfeathered tarsi were not considered significant.

Measurements of part of the U. S. National Museum series of *Collocalia unicolor amelis* are as follows:

Sex.	Locality.	Date.	Wing.	Tail.	Exposed Culmen.	Tarsus.
♂	Irisan, Benguet, Luzon, [P. I.] <sup>20</sup>	May 19, 1903	113	53	5	9.5
♀	" " " "	" " " "	113	50	5	10
♀	" " " "	June 3, 1903	111.5	50	4.5	9.5
♀	" " " "	" " " "	120	49.5	5	9.5
♀	Mindanao, P. I. ....	Nov. 28, 1887	118	46	5	10
♀	Palawan, P. I. ....	Sept. 5, 1887	118	49.5	5	9.5
♀	Irisan, Benguet, Luzon, [P. I.]	June 3, 1903	117	50	5	10
♀	" " " "	" " " "	123	50	5	10.5
♀	" " " "	" " " "	109.5	50	4.5	10
♀	" " " "	" " " "	116.5	50	4	10
Average.....			116	49.8	4.8	9.9

<sup>18</sup> *Ibis*, 1895, p. 462.

<sup>19</sup> *Novit. Zool.*, VI, 1899, p. 211.

<sup>20</sup> Type.

*Collocalia leucophaea* (Peale).

*Macropteryx leucophaeus* Peale, United States Explor. Exped., VIII, 1848, p. 178, pl. XLIX, fig. 3.

*Collocalia cinerea* Cassin, United States Explor. Exped., Mamm. and Ornith., 1858, p. 183, pl. XII, fig. 4 (Tahiti Island, Society Islands) (*nec* Gmelin).

*Chars. sp.*—Similar to *Collocalia unicolor unicolor*, but larger; upper parts, including wings and tail, more brownish, with less metallic sheen, and less uniform, the pileum somewhat darker, the rump paler, than the back; feathers of the lores with light brownish instead of white bases.

Wing, 120–127; tail, 56–59; exposed culmen, 4.5–5; tarsus, 9.5–10 mm.

*Type locality.*—Tahiti Island, Society Islands.

*Geographical distribution.*—Tahiti Island, Society Islands, Pacific Ocean.

This very distinct species is superficially somewhat like *Collocalia fuciphaga elaphra* from the Seychelles, but lacks the tarsal feathers; is larger, more brownish above, with less metallic gloss; much darker, duller, more uniform on the lower surface; and has brownish in place of white bases to the loreal feathers. It is of course still more different from *Collocalia fuciphaga fuciphaga*, being much larger, decidedly more brownish, with scarcely any metallic gloss above, and having neither feathers on the tarsi nor white bases to the feathers of the lores. On the Island of Tahiti alone is this species positively known to occur, since all the specimens from the Marquesas Islands now at hand prove to belong to *Collocalia ocista*. All previous records of this species from the Marquesas Islands therefore need verification, though of course its occurrence there is by no means improbable.

Even if the name given to this species by Cassin—*Collocalia cinerea*<sup>21</sup>—were not, as has already been shown by Dr. Hartert,<sup>22</sup> a mistaken identification of his specimen with the *Hirundo cinerea* of Gmelin,<sup>23</sup> which is a swallow—*Atticora cinerea*—it would still not be the tenable name for the present species, since it is ten years posterior to the *Macropteryx leucophaeus* of Peale,<sup>24</sup> and was based on the same type specimen which is yet in the U. S. National Museum.

*Collocalia thespesia* sp. nov.

*Chars. sp.*—Similar to *Collocalia francica germani*, but the wing slightly, the tail very much longer; upper parts lighter, more brownish;

<sup>21</sup> United States Explor. Exped., Mamm. and Ornith., 1858, p. 183, pl. XII, fig. 4.

<sup>22</sup> Cat. Birds. Brit. Mus., XVI, 1892, p. 502.

<sup>23</sup> Syst. Nat., I, ii, 1788, p. 1026.

<sup>24</sup> United States Explor. Exped., VIII, 1848, p. 178, pl. XLIX, fig. 3.

bases of the loreal feathers pale brown instead of pure white; sides of head and neck, together with entire lower surface, excepting the anal region, much darker and more uniform.

*Geographical distribution*.—Tahiti Island, Society Islands.

*Description*.—Type, female adult; Tahiti Island, Society Islands, November 14, 1899; C. H. Townsend. Pileum clove brown; cervix, back, upper tail-coverts, and part of rump rather lighter and slightly more rufescent with scarcely any metallic gloss; rump with a very light brown band, slightly whitish along the edges of the feathers, and similar to that of *Collocalia francica francica*, though apparently not quite so broad or so pale, the feathers with somewhat though not very conspicuously defined deeper brown shafts; wings and tail darker than upper parts, and somewhat blackish with a slight purplish or bluish sheen, but the basal portion of the rectrices and the inner edge of the wing-quills decidedly more brownish—much like the back; median and lesser wing-coverts with the tertials also rather lighter, more brownish than the quills, and somewhat glossed with greenish; sides of head clove brown almost as dark as the crown, the feathers of the lores with lighter brown bases; sides of neck brown like the cervix; lower surface the same, but lighter, becoming still a little paler on the abdomen, considerably so and appreciably more rufescent on the crissum; lining of wing clove brown.

Wing, 122; tail, 58; exposed culmen, 5; tarsus, 10 mm.

The single specimen of this new and remarkable species was obtained by Mr. Townsend during the cruise of the "Albatross" already mentioned. It differs very strongly from *Collocalia francica spodiopygia*, the light-rumped form from the Samoan Islands, in its larger size, lighter, much more brownish upper parts, rather more narrow rump band, darker, more uniform ventral surface, and especially, as from all other species of the entire genus excepting *C. leucophaea* and *C. ocista*, by the brownish instead of pure white bases of the loreal feathers. From *Collocalia leucophaea* it may of course be easily distinguished by the pale band across the rump, as well as by somewhat less brownish upper surface and decidedly paler anal region. From *Collocalia ocista* it differs in lack of tarsal feathers, in more brownish upper surface, pale rump band, and lighter anal region.

The only published name that can by any possibility apply to this species is *Hirundo peruviana* Forster,<sup>28</sup> based on a specimen said to have been obtained on Tahiti. But unless the description of this bird is very erroneous it cannot refer to *thespesia*, as the following quotation

<sup>28</sup> *Descript. Anim.*, 1844, p. 240.

will show: "Corpus totum supra cum remigibus, reatricibusque nigro-nitens. Uropygium, gula, pectus, abdomen, crissum cinereo-fuliginosa."<sup>28</sup> The upper surface in *thespesia* is by no means "nigro-nitens," being dark brown, scarcely more blackish than the same part in *Collocalia leucophaea*; while the rump is not of the same color as the dark gray ventral surface, but is very much paler, even whitish. The description of *peruviana* very much better fits *Collocalia francica spodiopygia*, to which it should probably be referred.

**Collocalia francica francica** (Gmelin).

*Hirundo francica* Gmelin, Syst. Nat., I, ii, 1788, p. 1017.

*Hirundo francica* Vieillot, Nouv. Dict. d'Hist. Nat., XIV, 1817, p. 525 (Mauritius).

*Hirundo francica* Lesson, Traité d'Ornith., 1831, p. 270 (Mauritius).

**Chars. sp.**—Like *Collocalia unicolor amelis*, but somewhat smaller; rather more brownish above, with a distinct broad whitish or brownish white band across the rump; paler below, especially on the abdomen and crissum; lining of wing paler, more brownish.

Wing, 112–114; tail, 51–52; exposed culmen, 4–5; tarsus, 8.5–10 mm.

**Type locality.**—Mauritius Island.

**Geographical distribution.**—Islands of Mauritius and Bourbon; ? Ceylon.

This form bears some resemblance to *Collocalia innominata*, but is of course much smaller; more brownish above, with a paler rump band which has not conspicuously darker shafts; darker below, particularly posteriorly, without noticeably darker shaft lines; and lacks feathers on the tarsus. It seems to be confined to the Islands of Mauritius and Bourbon, for although several times accredited to Madagascar its occurrence there remains to be confirmed; and all the East Indian records belong to other subspecies.

**Collocalia francica townsendi** subsp. nov.

**Chars. subsp.**—Similar to *Collocalia francica francica*, but wing longer; upper surface darker, more blackish, and more glossed with greenish, the rump band on the contrary more whitish; lower surface darker.

**Geographical distribution.**—Tonga Islands.

**Description.**—Type, adult female; Eua Island, Tonga (Friendly) Islands, November 28, 1899; C. H. Townsend. Upper parts, including wings and tail, brownish black with a greenish metallic sheen, the inner webs of the rectrices, especially on their basal portions, and particularly the inner webs of the wing-quills, more brownish; a conspicuous

<sup>28</sup> *Ibid.*, p. 241.

brownish white—almost pure white—band on the rump, its feathers with slightly though not very noticeably dusky shafts; sides of head clove brown, the lores darker, with white bases; sides of neck somewhat lighter brown; lower surface brownish gray, darkest on chin and the longest lower tail-coverts, decidedly paler, even almost whitish, on lower abdomen and anal region; lining of wing clove brown.

From *Collocalia francica spodiopygia*, to which this form has heretofore been referred, it differs in considerably more greenish glossy upper surface, much more whitish rump, and paler posterior lower parts. It has the most whitish rump of any subspecies of *C. francica*, and seems furthermore to be one of the best marked of these. It is another of the novelties brought back by Mr. C. H. Townsend from his Pacific cruise in 1899–1900, and was obtained in only the Tonga group—on Eua, Vavau and Niue Islands.

Measurements of these specimens are as follows:

Sex.	Locality.	Date.	Wing.	Tail.	Exposed Culmen.	Tarsus.
♂	Vavau I., Tonga Islands.	Dec. 4, 1899	116	52	4	9
♂	Niue I., " "	Nov. 25, 1899	116.5	54	4	9
♂	Eua I., " "	Nov. 28, 1899	117	50	4	9
Average.....			116.5	52	4	9

***Collocalia francica terræreginae* (Ramsay).**

*Cypselus terræ-reginae* Ramsay, Proc. Zool. Soc. Lond., 1874, p. 601.

*Collocalia infuscata* Salvadori, Atti R. Accad. Sci. Torino, XV, 1880, p. 348 (Ternate Island, Molucca Islands).

*Chars. subsp.*—Similar to *Collocalia francica francica*, but somewhat smaller; upper surface darker; posterior lower parts more deeply colored, imparting thus a more uniform appearance to the ventral surface; feathers of the light rump band with more conspicuously blackish shaft lines.

Wing, 110–111; tail, 48–53; exposed culmen, 5; tarsus, 8.7–10 mm.

*Type locality.*—Cardwell, Rockingham Bay, Queensland, Australia.

*Geographical distribution.*—Northern Queensland and southern New Guinea to Jampea Island, Ternate Island and probably also other islands of the Molucca group.

This race may be distinguished from *Collocalia francica spodiopygia* chiefly by its much smaller size, more conspicuously blackish shaft

lines on the feathers of the light rump band, and by more glossy upper surface. From *Collocalia francica townsendi* it differs in shorter wing, less whitish rump band with conspicuous blackish shaft lines, and darker abdomen.

The subspecific separation of the present form is made principally on the basis of the bird from Ternate Island, described by Count Salvadori as *Collocalia infuscata*,<sup>28</sup> which is certainly different from both *francica* and *spodiopygia*, although considered by Dr. Hartert as inseparable from the latter.<sup>29</sup> Although no specimens from northern Queensland, the *Cypselus terraereginae* of Ramsay,<sup>30</sup> have been examined in the present connection, the characters of size and coloration assigned them agree apparently best with this form, for which therefore *terraereginae* by priority becomes the proper subspecific name. Should, however, the birds from Queensland, which are undoubtedly not to be referred to *spodiopygia*, and probably not to *francica*, ultimately prove to be different from those of the Molucca Islands, the latter must stand as *Collocalia francica infuscata* Salvadori.

***Collocalia francica spodiopygia* (Peale).**

*Hirundo peruviana* Forster, Descript. Anim., 1844, p. 240 (Tahiti Island, Society Islands) (nec Gmelin).

*Macropteryx spodiopygius* Peale, United States Explor. Exped., VIII, 1848, p. 176, pl. XLIX, fig. 2 (Upolu Island, Samoa Islands).

*Herse forsteri* Hartlaub, Journ. f. Ornith., 1854, p. 169 (nom. nov. pro *Hirundo peruviana* Forster).

*Chars. subsp.*—Like *Collocalia francica francica*, but wing longer; upper parts more blackish and less glossy; also lower surface, particularly the abdomen, darker; rump band less whitish.

Wing, 116–117; tail, 48–54; exposed culmen, 4–5; tarsus, 8–9 mm.

*Type locality.*—Upolu Island, Samoa Islands.

*Geographical distribution.*—Solomon, Samoan, and Fiji Islands; Tahiti Island.

This dark form from western Polynesia certainly deserves recognition on good average characters as distinguished from *Collocalia francica francica* with which it has heretofore been synonymized. It is, indeed, both in color and size, apparently nearer *Collocalia francica inexpectata*, from which it differs chiefly in its smaller size, less glossy upper surface, lighter rump band, and obsolescence, usually absence, of dark shaft lines on rump and under parts. Peale's type of

<sup>28</sup> *Atti R. Accad. Sci. Torino*, XV, 1880, p. 348.

<sup>29</sup> *Cat. Birds Brit. Mus.*, XVI, 1892, p. 504.

<sup>30</sup> *Proc. Zool. Soc. Lond.*, 1874, p. 601.

*spodiopygia* is still in the United States National Museum, and fairly well preserved.

The name *Hirundo peruviana* Forster,<sup>31</sup> based on specimens from Tahiti, seems recently to have been pretty generally ignored or overlooked; but that it in all probability applies to this form, as some authors have indicated, notwithstanding that there is no other record from Tahiti, may easily be seen by examination of the excellent original description.<sup>32</sup> It is, however, unavailable for use in the present case, since it is preoccupied by *Hirundo peruviana* Gmelin,<sup>33</sup> which is certainly some other bird. The *Herse forsteri* of Hartlaub<sup>34</sup> is, as he states, a renaming of Forster's *Hirundo peruviana*, but is antedated by *Macropteryx spodiopygius* Peale.<sup>35</sup>

*Collocalia francica inexpectata* Hume.

*Collocalia inexpectata* Hume, Stray Feathers, I, 1873, p. 296.

*Chars. subsp.*—Similar to *Collocalia francica francica*, but larger; upper surface decidedly darker, less brownish, and with more metallic greenish gloss; wings and tail with more metallic bluish and purplish tinge; rump much darker, making its light band less well defined, the feathers with much more distinct blackish shaft lines; lower parts, particularly abdomen and crissum, darker, more uniform, and with more evident dusky shaft lines.

Wing, 114–124; tail, 50–54; exposed culmen, 4.5–5; tarsus, 9.5–10.5 mm.

*Type locality.*—Button Island, Andaman Islands.

*Geographical distribution.*—Southern Andaman Islands; Nicobar Islands; Pulo Tioman; and both coasts of the southern part of the Malay Peninsula; ? accidental in Amherst, Tenasserim (Hartert).

This race may be distinguished from *Collocalia f. townsendi* by somewhat larger average size, much darker rump band with blackish shaft lines more conspicuous, and decidedly more deeply colored posterior lower parts, with evident darker shaft lines; from *Collocalia f. terrae-reginae* by much greater size, darker rump band, and more noticeable dark shaft lines on abdomen and crissum. It differs from *Collocalia francica spodiopygia* in its somewhat greater size, more glossy upper surface, more bluish and purplish metallic sheen on wings and tail, presence of appreciably dusky shaft lines on the posterior lower parts,

<sup>31</sup> *Descript. Anim.*, 1844, p. 240.

<sup>32</sup> *Ibid.*

<sup>33</sup> *Syst. Nat.*, I, ii, 1788, p. 1025.

<sup>34</sup> *Journ. f. Ornith.*, 1854, p. 169.

<sup>35</sup> *United States Explor. Exped.*, VIII, 1848, p. 176, pl. XLIX, fig. 2.



and in duller, less well-defined rump band, the feathers of which have much more conspicuous dark shaft lines.

Birds from the southern part of the Malay Peninsula—both eastern and western sides—as well as from Pulo Tioman, off the east coast, average larger than those from the Andaman and Nicobar Islands; but this is apparently too slight and inconstant, in the absence of any accompanying color difference, to warrant recognition by name. In *C. f. inexpectata* as in other forms there is considerable individual color variation, evident in this case chiefly on the lower parts and the light rump band. The single specimen of *inexpectata* recorded by Dr. Hartert<sup>26</sup> from Amherst, Tenasserim, is possibly rather to be referred to *Collocalia f. germani*, for it is more probably an unusually dark example of the latter, whose home is near by, than a stray from the far-off southern Andaman Islands.

*Collocalia francica germani* Oustalet.

*Collocalia germani* Oustalet, Bull. Soc. Philom. Paris, 1876, pp. 1-3.

*Collocalia francica*, subsp.  $\beta$ . *merguiensis* Hartert, Cat. Birds Brit. Mus., XVI, 1892, p. 506 (Mergui, Tenasserim).

*Chars. subsp.*—Similar to *Collocalia francica francica*, but larger; upper surface more glossed with metallic greenish; light rump band with more evident blackish shaft lines; posterior lower surface darker, and with more conspicuous dark shaft lines.

Wing, 115-121.5 (average, 118.3); tail, 49-52.5 (average, 51.3); exposed culmen, 4.5-5 (average, 4.9); tarsus, 9-11 (average, 10) mm.<sup>27</sup>

*Type locality.*—Condore Island, China Sea, off the southeastern coast of Cochin China.

*Geographical distribution.*—Mergui Archipelago; Tenasserim; Malay Peninsula south to Lower Siam; Condore Island, Cochin China; Philippine Islands.

Like many of the forms of *Collocalia*, this race is, on account of individual variation, difficult to determine satisfactorily without a sufficient series, but it is nevertheless worthy of recognition. It is distinguishable from *Collocalia f. spodiopygia* by its lighter, more greenish glossy upper surface, more metallic bluish and purplish sheen on wings and tail; well-defined blackish shaft streaks on the feathers of the light rump band; paler lower parts, with dark shaft streaks on abdomen; and somewhat larger size. From *Collocalia f. townsendi* it may be separated by rather greater size; lighter, more brownish upper

<sup>26</sup> Cat. Birds Brit. Mus., XVI, 1892, p. 505; *Tierreich*, I, 1897, p. 69.

<sup>27</sup> Ten specimens.

parts; less whitish rump band and darker abdomen, both with more distinct dusky or blackish shaft lines. From *Collocalia f. terraereginae* it may be distinguished by its much larger size, lighter, more brownish upper surface, and more conspicuous dark shaft lines on the posterior lower parts. From *Collocalia f. inexpectata* it differs in its decidedly paler under surface; lighter, more brownish upper parts; and more prominent, less brownish, light rump band; but occasional intermediate individuals occur that are difficult to distinguish. The dark shaft lines of the lower surface vary much in different individuals, being apparently most evident in immature birds. The measurements of this form given by Hartert<sup>38</sup> are rather too large, as may be seen by reference to the above averages, but were probably taken from a limited number of specimens. A series of birds from Trong, Lower Siam, and another from the Philippine archipelago seem to be identical, and together are certainly all referable to this race, although a few of those from Cagayan Sulu, in the southwestern Philippines, are more blackish above and show in this, but not in size, some vergence toward *Collocalia francica terraereginae*. There are examples in the United States National Museum from the following islands of the Philippines: Panay; Cagayan Sulu; and Cagayancillo, in the Cagayanes group. It has also been recorded as *Collocalia francica* from Cuyo, Negros and Calamianes. All Philippine records of both *francica* and *inexpectata* refer of course to *germani*.

The identity of *Collocalia germani* Oustalet and *Collocalia francica merquiensis* Hartert may be considered as conclusively established, for Dr. Hartert assures us<sup>39</sup> that he has compared the types. That *germani* is rightly considered a subspecies of *Collocalia francica* seems to be equally certain, for Dr. R. Bowdler Sharpe, who at our request carefully examined the series of *merquiensis* in the British Museum, informs us<sup>40</sup> that there is not the slightest indication of tarsal feathering on any of the specimens.

***Collocalia troglodytes* Gray.**

*Collocalia troglodytes* Gray, Gen. Birds, I, 1845, p. 55, pl. 19.

*Chars. sp.*—Very much smaller than *Collocalia francica francica*; upper parts, including wings and tail, black with a metallic greenish or bluish gloss; a pure white, well-defined rump band, the feathers of which have blackish shafts and most of them dark tips; abdomen

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<sup>38</sup> *Cat. Birds Brit. Mus.*, XVI, 1892, p. 506; *Tierreich*, I, 1897, p. 69.

<sup>39</sup> *In litt.*

<sup>40</sup> *In litt.*

white or whitish in contrast to most of the remaining more or less deeply brownish lower parts; under tail-coverts like the back; lining of the wing rather more brownish.

Wing, 86-96; tail, 38-42; exposed culmen, 3.5; tarsus, 9-9.5 mm.

*Type locality*.—Philippine Islands.

*Geographical distribution*.—Philippine Islands.

This very distinct species differs markedly from all the preceding forms with unfeathered tarsi in its small size, deeply blackish upper surface, white abdomen, and peculiar white rump band. It is superficially very similar to *Collocalia leucopygia*, but aside from the lack of tarsal feathers is easily distinguished from that species by its more greenish upper surface, broad blackish tips to the white feathers of the rump band; and more extensively blackish lower tail-coverts. There is considerable variation in the wing-length of *C. troglodytes*, but this does not seem to be correlated with different geographical areas.

The species has been obtained on the following islands of the Philippine archipelago: Mindanao, Palawan, Siquijor, Cebu, Masbate, Negros, Guimaras, Panay, Romblon, Sibuyan, Mindoro, Luzon, Marinduque, Samar, Leyte, and Ticao.

*Collocalia uropygialis* Gray.

*Collocalia uropygialis* Gray, Ann. and Mag. Nat. Hist., ser. 3, XVII, 1866, p. 123.

*Chars. sp.*—Similar to *Collocalia troglodytes*, but rather larger; feathers of the white band on the rump without blackish shafts or tips; most of the rectrices usually with white spots on the basal portion of inner webs; some of the under wing-coverts and lower tail-coverts with whitish tips or margins.

Wing, 89-99; tail, 38-44; tarsus, 7 mm.

*Type locality*.—Aneiteum Island, New Hebrides Islands.

*Geographical distribution*.—New Caledonia and New Hebrides Islands.

Readily distinguished from all the other light-rumped forms of the genus by the white spots on the tail-feathers; with the remaining species it needs no special comparison.

*Collocalia marginata* Salvadori.

*Collocalia marginata* Salvadori, Atti R. Acad. Sci. Torino, XVII, 1882, p. 448.

*Collocalia cebuensis* Kutter, Journ. f. Ornith., 1882, p. 171 (Cebu Island, Philippine Islands).

*Chars. sp.*—Somewhat like *Collocalia uropygialis*, but larger; rather more greenish above; rump without a white band, but its feathers with conspicuous white edgings; rectrices never with white spots.

Wing, 103-107; tail, 41-43; exposed culmen, 3.5-4; tarsus, 7.5-9 mm.

*Type locality*.—Cebu Island, Philippine Islands.

*Geographical distribution*.—Philippine Islands.

This interesting bird, supposed until recently to be very rare, bids fair to be found distributed pretty generally throughout the Philippine archipelago. Up to the present time it has been ascertained to occur on the following islands: Cebu, Masbate, Luzon (*McGregor*), Mindoro, Calayan, and Sibuyan.

It scarcely needs close comparison with any other member of the genus except *Collocalia linchi*, and to distinguish it from this there should be no difficulty. The white margins of the brownish gray feathers of the throat and breast are usually broad and conspicuous, but occasionally in even unworn specimens are almost obsolete.

*Collocalia linchi linchi* Horsfield and Moore.

? *Hemiprocne fucivora* Streubel, Isis, 1848, p. 369 (East Indies).

*Collocalia linchi* Horsfield and Moore, Cat. Birds Mus. East Ind. Comp., I, 1854, p. 100 (Java).

*Chars. subsp.*—Very much like *Collocalia marginata*, but feathers of the rump without white margins; upper surface usually more brightly colored; throat and breast generally with less conspicuous white edgings.

*Type locality*.—Java.

*Geographical distribution*.—Java; Lombok; Kangean Islands; Sumatra, including the islands along its western coast; Singapore, and the southern part of the Malay Peninsula; Borneo(?).

This species is shown by the considerable amount of material from various parts of its range now in the United States National Museum to be divisible into several recognizable races which are diagnosed below. Aside from the evident geographical variation there are some differences that seem to be due to wear of the plumage and to obtain alike in all the forms. The color of the upper parts changes little through sex, age, or season, although there is a normal but not very considerable amount of individual variation. The deep gray of the anterior lower parts is decidedly more brownish when the feathers become old; and the white or whitish margins that in fresh plumage are often very conspicuous on throat, breast, and under wing-coverts sometimes almost entirely disappear through abrasion. Likewise the broadly white edgings of sides, flanks, and lower breast wear off and ultimately allow much of the slate gray bases of the feathers to show, in this way decidedly darkening the general appearance of the parts.

This form of *Collocalia linchi*, as compared with the other sub-

species, is characterized by large size, and by very greenish upper parts, including wings and tail, with but slight tinge and very little or no admixture of bluish. The United States National Museum possesses a fair series from Sikakap Strait, North Pagi Island, off the western coast of Sumatra; and a specimen from Singapore is also identical. Borneo is doubtfully included in the range of this race, as we have examined no specimens from that island, and its bird may be like that of either the Natuna Islands or even the Philippines, or may prove to be an endemic form.

Measurements of *Collocalia linchi linchi* are as follows:

Ser.	Locality.	Date.	Wing.	Tail.	Exposed Culmen.	Tarsus.
1	Sikakap Str., No. Pagi I.	Nov. 12, 1902.	105	44	4.5	8.5
2	" "	" "	103	43	4.5	9
3	" "	" "	105.5	42	4.5	9
4	" "	" "	104.5	42	4.5	8.5
5	" "	" "	103.5	42.5	4.5	8.5
6	Singapore	Aug. 28, 1879	105	42	4.5	9
Average.....			104.4	42.6	4.5	8.8

*Collocalia linchi cyanoptila* subsp. nov.

*Chars. subsp.*—Similar to *Collocalia linchi linchi*, with which it agrees in size, but upper surface of head and body much more bluish in shade, and with considerable admixture of bluish purple; wings, and particularly the tail, decidedly more bluish.

*Geographical distribution.*—Natuna Islands and Linga Island.

*Description.*—Type, adult female, No. 174,688, U. S. N. M.; Bungan Island, Natuna Islands, July 1, 1900; Dr. W. L. Abbott. Upper parts metallic dark bluish green, much mixed with bluish purple, most noticeably so on posterior portion; tail bluish green decidedly tinged with purplish; wings sepia brown, dull metallic purplish on most of their exposed portions, the coverts more brightly colored, and mixed with dark green; sides of head and neck, throat, breast, flanks, and sides of body brownish slate, the feathers of the lores with cottony white bases, those of throat and breast with inconspicuous pale gray or whitish tips, those of lower breast, sides, and flanks broadly margined and terminated with white; median portion of abdomen white with some narrow slaty shaft streaks; lower tail-coverts dark bluish metallic green, the longer ones immaculate, the shorter ones margined with white; lining of wing dull dark metallic green.

This new race is quite different from true *Collocalia linchi*, the only form of the species with which it agrees in size, and it may readily be distinguished on even superficial comparison by the difference in the color of the upper parts. The best and most uniform character is the always much more bluish or purplish color of the upper surface of the tail. A single adult male from Linga Island, southeast of Singapore, is intermediate between *cyanoptila* and *linchi*; but there is so much purplish and bluish in the color of the upper parts, and the tail is so nearly like that of *cyanoptila*, that the specimen must apparently be referred to the latter, although this island is far from the Natuna group, and in a location where *linchi* is the form we should naturally expect to find. Further examples from Linga may, however, show that the average characters of the bird found there will place it with *linchi*.

Measurements of the adults of *Collocalia linchi cyanoptila* are as follows:

Sex.	Locality.	Date.	Wing.	Tail.	Exposed Culmen.	Tarsus.
♀	Bunguran I., Natuna Is. <sup>a</sup>	July 1, 1900	107	41	4.5	7.5
♀	" "	" "	102	41	4.5	8.5
?	" "	July 11, 1900	108	43	4.5	8
♂?	Linga Island.....	July 10, 1899	101.5	40	4	7.5
Average.....			104.6	41.3	4.4	7.9

***Collocalia linchi affinis* Beavan.**

*Collocalia affinis* Beavan, Ibis, 1867, p. 318 (ex Tytler MS.).

*Chars. subsp.*—Similar to *Collocalia linchi cyanoptila*, but very much smaller.

*Type locality.*—Port Blair, South Andaman Island, Andaman Islands.

*Geographical distribution.*—Andaman and Nicobar Islands.

This form, long ago described from the southern Andaman Islands by Beavan, has hitherto usually been considered the same as *linchi*. The satisfactory series obtained by Dr. W. L. Abbott in the Nicobar Islands, however, now conclusively establishes its claim to recognition. It differs from true *linchi* in its much smaller size, and the decidedly bluish or purplish shade of the upper surface, particularly the tail-coverts and tail.

<sup>a</sup> Type.

Measurements of *Collocalia linchi affinis* are as below:

Sex.	Locality.	Date.	Wing.	Tail.	Exposed Culmen.	Tarsus.
♀	Little Nicobar I., Nicobar	Is. Mar. 2, 1901	98	40	4	8.5
♀	" "	" " "	98	41.5	4	8.5
♀	" "	Feb. 26, 1901	99	39	4	8
♀	" "	" " "	100	41	4	8
♀	" "	Feb. 27, 1901	101	39.5	4	8
♀	" "	" " "	99	38	4	8
Average.....			99.2	39.8	4	8.2

*Collocalia linchi elachyptera* subsp. nov.

*Chars. subsp.*.—Similar to *Collocalia linchi affinis*, but more greenish on all the upper parts, particularly on back, wings, and tail.

*Geographical distribution.*—Islands of the Mergui Archipelago.

*Description.*—Type, adult male, No. 173,028, U. S. N. M.; Bentinck Island, Mergui Archipelago, March 9, 1900; Dr. W. L. Abbott. Upper parts deep metallic green, with an appreciable bluish purple tinge, particularly on the upper tail-coverts; tail the same, but more bluish; wings fuscous, the exposed portion of quills and primary coverts with a dull metallic purplish sheen, the other superior coverts like the back; lores dark brown, the feathers with pure white bases; rest of sides of head and neck, with chin, throat, and breast, dull brownish slate color, the feathers of the throat and upper breast with pale grayish or whitish tips; lower breast, sides, and flanks brownish slate with a slight metallic greenish sheen, the feathers all broadly margined with white which much obscures the darker color; middle of abdomen white with shaft markings of dusky; exposed portions of lower tail-coverts dark metallic greenish, the shortest brownish, all but the longest broadly bordered with white; lining of wing dark brown, glossed with metallic green. "Bill black; iris dark brown; feet dark fleshy brown."

This race is of course intermediate between *Collocalia linchi affinis*, from the Andaman Islands, and *Collocalia l. isonota*,<sup>a</sup> from the Philippines; but the differences that characterize it are readily appreciable in a series, as well as in a large proportion of individual specimens, and seem, particularly when its isolated range is taken into account, quite sufficient for its recognition by name. It is readily distinguishable from true *linchi* by reason of its much inferior dimensions

<sup>a</sup> *Postea*.

and more bluish or purplish upper parts, especially wings and tail; from *cyanoptila* by its small size and more greenish upper surface, including wings and tail. So far as known it does not occur outside the Mergui Archipelago, where it has been taken on only Bentinck Island; but it undoubtedly is to be found on other islands of the group, while there would seem to be no improbability of its occasional if not regular occurrence on the adjacent mainland.

Measurements are subjoined:

Sex.	Locality.	Date.	Wing.	Tail.	Exposed Culmen.	Tarsus.
♂	Bentinck I., Mergui Arch.	Mar. 10, 1900	101	41	4	8.5
	" " "	Mar. 9, 1900	98.5	39	4.5	8
	" " "	"	100	42.5	4.5	8.5
	" " "	"	100.5	41	4.5	9
	" " "	"	97	39	4.5	8.5
	Average.....		99.4	40.5	4.4	8.5

*Collocalia linchi isenota* subsp. nov.

*Chars. subsp.*—Resembling *Collocalia linchi elachyptera*, but averaging slightly larger; color of upper parts decidedly duller and somewhat less bluish or purplish.

*Geographical distribution.*—Philippine Islands.

*Description.*—Type, adult male, No. 192,610, U. S. N. M.; Irisan, Benguet, Luzon, Philippine Islands, June 3, 1903; R. C. McGregor and A. Celestino. Upper surface dull, dark, metallic green, the crown and upper tail-coverts with a slight bluish tinge; tail of the same color, scarcely more bluish; wings fuscous, the exposed surface of the quills dull greenish blue with but little metallic sheen, the superior coverts like the back; lores dark brown, the feathers with pure white bases; sides of head and neck, chin, throat, breast, sides, and flanks brownish slate color, the throat and breast feathers with margins of pale grayish or whitish, those of lower breast, of sides and flanks so broadly bordered with white that the ground color is largely overlaid; median portion of abdomen white, with very fine dusky shaft lines; longest lower tail-coverts dull, dark, metallic green, slightly or not at all margined with whitish, the shorter ones brownish with ample white edges, or nearly all white with a dusky shaft-stripe; lining of wing dark brown, slightly glossed with metallic greenish.

This race differs from *Collocalia linchi linchi* in its smaller size and

<sup>a</sup> Type.



much duller, slightly more bluish upper parts; from *C. l. cyanoptila* in inferior size and much duller, more greenish upper surface; and from *C. l. affinis* in somewhat longer wing, slightly shorter tail, and decidedly duller, more greenish upper parts, particularly the tail.

Birds in juvenal plumage, even before their wings and tails are fully grown, seem to be exactly like the adults in color above, and not appreciably different below except for possibly broader, more evident white margins on lower breast, sides, flanks, and lining of wing.

This form of *Collocalia linchi* appears to be confined to the Philippine archipelago, and has been taken on only Luzon, Mindoro, Mindanao, and Bongao.

Measurements of three adults are as under:

Sex.	Locality.	Date.	Wing.	Tail.	Exposed Culmen.	Tarsus.
♂	Irisan, Benguet, Luzon,	[P. I. May 17, 1903	101.5	37	3.5	8.5
	" " "	June 6, 1903	100	39.5	4	9
	" " "	May 8, 1903	100.5	36.5	4	9
	Average.....		100.7	37.7	3.8	8.8

***Collocalia dodgei* Richmond.**

*Collocalia dodgei* Richmond, Smithson. Quart., II, 1905, p. 431.

*Chars. sp.*—Resembling *Collocalia linchi isonota*, but very much smaller; upper parts still duller, more sooty, with an even more greenish metallic gloss.

Wing, 88.5; tail, 33; exposed culmen, 3.5; tarsus, 7 mm.

*Type locality.*—Mount Kina Balu, northeastern Borneo.

*Geographical distribution.*—Mount Kina Balu, northeastern Borneo.

*Description.*—Type, adult, sex unknown, No. 191,575, U. S. N. M.; Mount Kina Balu, Borneo, spring of 1904; George H. Goss and H. D. Dodge. Upper parts dull brownish black with an appreciable oil-green metallic gloss, the pileum slightly darker; tail and superior tail-coverts darker greenish, somewhat shaded with bluish and without trace of white markings; wings like the tail, but inner margin of quills brownish with little or no metallic sheen, and upper wing-coverts, with innermost secondaries, more greenish like the back; sides of head and neck, chin, throat, breast, sides, and flanks brownish slate, darkest

<sup>44</sup> Type.

<sup>45</sup> Dr. Richmond's measurement of the wing is too great (*loc. cit.*).

on sides of head, the feathers of lores with pure white bases, those of middle of lower throat and breast slightly, of the sides and flanks more or less broadly, margined with whitish; centre of abdomen white; lower tail-coverts dusky with a slight greenish gloss, the longest ones narrowly, the shorter ones conspicuously edged all around with white, some of the shortest entirely white save for a narrow dusky shaft line; under wing-coverts blackish with the dull oil-green gloss of the upper surface; a few of the dark brown axillars tipped with white.

This remarkably distinct species continues to be known from only the type specimen, which was obtained by Messrs. Goss and Dodge during their recent expedition to Mount Kina Balu. This example is fully adult and in perfect plumage.

By reason of its white abdomen, uniform greenish upper parts, with lack of any white on the rump and also of white markings on the tail, *Collocalia dodgei* needs special comparison with none of its congeners unless it be *C. linchi*. From the typical form of the latter species it differs even more than from *C. l. isonota*, the one to which it seems to be most closely allied, but from which, however, it is specifically distinct. Whether the previous records of *Collocalia linchi* from Mount Kina Balu and from other parts of Borneo belong to this newly described species or to some form of *linchi* we are unable with our present material to determine, and this will be an interesting question for future investigation.

***Collocalia esculenta* (Linnæus).**

*Hirundo esculenta* Linnæus, Syst. Nat., ed. 10, I, 1758, p. 191 ("China" locality wrong; Amboina is the proper type locality).

*Collocalia hypoleuca* Gray, Proc. Zool. Soc. Lond., 1858, p. 170 (Aru Islands).

*Collocalia viridinitens* Gray, Ann. and Mag. Nat. Hist., ser. 3, XVII, 1866, p. 120 (Celebes).

*Collocalia spilura* Gray, Ann. and Mag. Nat. Hist., ser. 3, XVII, 1866, p. 120 (Batchian).

*Chars. sp.*—Resembling *Collocalia linchi*, but averaging decidedly smaller; most of the rectrices with large white spots on the basal portion of their inner webs.

Wing, 69–103; tail, 38–44; exposed culmen, 3.5–4; tarsus, 8 mm.

*Type locality.*—Amboina Island, Molucca Islands.

*Geographical distribution.*—East India Islands from Celebes and Sumbawa Island to the Solomon Islands and the Louisiade Archipelago, including New Guinea; Cape York, Queensland, Australia.

Dr. Hartert is undoubtedly correct in his identification and adoption of Linnæus' *Hirundo esculenta*,<sup>4</sup> even though the latter author gives

<sup>4</sup> *Syst. Nat.*, ed. 10, I, 1758, p. 191.

the locality wrong, since the description given by Rumphius,<sup>47</sup> whom Linnæus cites, refers without doubt to the present species.

There seem to be at least two forms included under the name *esculenta* as now current, but the material at our disposal does not permit a satisfactory segregation of these.

*Collocalia neglecta* Gray.

*Collocalia neglecta* Gray, Ann. and Mag. Nat. Hist., ser. 3, XVII, 1866, p. 121.

*Chars. sp.*—Similar to *Collocalia esculenta*, from which it differs in the much duller, and greenish instead of bluish or purplish upper surface; rump, wing-quills, and wing-coverts with light grayish tips that are, however, sometimes obsolescent, particularly in old or worn birds.

Wing, 88–97; tail, 41–43; exposed culmen, 3.5–4; tarsus, 6.5 mm.

*Type locality.*—Eastern Timor.

*Geographical distribution.*—East Indian Islands of Timor, Savu, Alor, Dammer, Roma, Kisser, and Wetter.

In the specimens from Timor examined the upper parts are dull grayish metallic green, the wings and tail slightly more bluish; the anterior lower parts, including the breast, brownish gray, the feathers tipped with grayish white, producing a mottled appearance, the middle of the breast and jugulum having most white, the chin scarcely any; abdomen nearly pure white; feathers of the sides with brownish gray centres and whitish margins much like the breast; lining of wing dark brown slightly mixed with whitish.

Judging from Dr. Hartert's remarks,<sup>48</sup> birds of this species from Timor are not just like those on the neighboring islands, and the latter may as he suggests be subspecifically separable. This species is very different from all members of the genus excepting *Collocalia natalis* and *C. esculenta*, and may easily be distinguished by its dull greenish upper parts combined with white-spotted tail-feathers. It is of course near *Collocalia esculenta*, but apparently quite distinct enough to stand as a species, although Dr. Hartert is of opposite opinion.<sup>49</sup>

*Collocalia natalis* Lister.

*Collocalia natalis* Lister, Proc. Zool. Soc. Lond., 1888, p. 520.

*Chars. sp.*—Similar to *Collocalia neglecta*, but white markings of tail not sharply defined; chin and upper throat darker, almost black-

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<sup>47</sup> *Herb. Amboin.*, VI, 1750, p. 183.

<sup>48</sup> *Novit. Zool.*, IV, 1897, p. 268.

<sup>49</sup> *Novit. Zool.*, XI, 1904, p. 203.

ish; blackish shaft markings of the shorter under tail-coverts larger; feathers of the rump with somewhat broader white edgings.

Wing, 122 mm.

*Type locality*.—Christmas Island, Indian Ocean, south of western Java.

*Geographical distribution*.—Christmas Island, Indian Ocean.

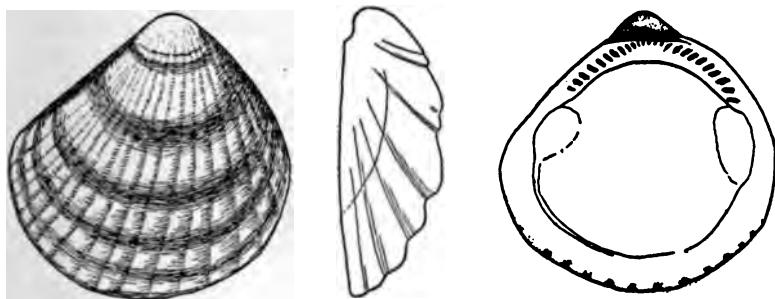
This little known form we have not seen; but it is apparently recognizable, though very much like *Collocalia neglecta*, of which it is possibly but a subspecies.

## DESCRIPTION OF A NEW AUSTRALIAN GLYCYMERIS.

BY HENRY A. PILSBRY.

*Glycymeris insignis* n. sp.

The shell is rounded-cuneate, the valves rather thick and strong, inequilateral, the posterior outline being longer and subangular, the anterior end rounded. The posterior dorsal slope is flat, and the beaks project well above the dorsal outline of the valve-edges. The



specimens are worn and without cuticle, white in the middle and anteriorly, pinkish orange near the posterior end. Sculpture of about 17 low rounded radial ribs parted by narrower intervals, and about six strong broad but unequal concentric waves separated by deep constrictions.

The waves and radial ribs are weak near the anterior end, and wanting on the flat posterior slope. The hinge-line is very strongly curved, the two sides at an angle of about 90 degrees to each other. The hinge-plate is moderately wide, with 12 anterior and 11 posterior teeth, three or four near the middle being very small and somewhat irregular. There is a small triangular area or lozenge below the beaks, sculptured *en chevron* with about six widely diverging grooves. The basal margin is coarsely crenulate inside in correspondence with the external ribs, and the concentric waves of the exterior are very weakly indicated inside.

Length 23, height 24, diameter 15.6 mm.

Length 23.5, height 23.3, diameter 16.7 mm.

Geographe Bay, West Australia. Cotypes two valves, right and left, received from Dr. J. C. Cox, of Sydney, New South Wales.

The strongly developed concentric sculpture of this species is unlike any described *Pectunculus* known to me. The flat posterior dorsal slope is another peculiar feature. Dr. Cox writes that it has never been found in fresh condition or with the valves attached.

## ON HAWAIIAN SPECIES OF SPHYRADIUM.

BY HENRY A. PILSBRY AND C. M. COOKE, JR.

The genus *Sphyradium* occurs over practically the whole Palearctic and Nearctic realms, with one species in the Neotropical, but it has not hitherto been reported from Polynesia. The two Hawaiian species to be described below have all the shell characters of the genus, but since the jaw and teeth of neither is known, their reference to *Sphyradium* is provisional.

*Sphyradium sharpi* P. and C., n. sp. Figs. 1, 2.

The shell is narrowly umbilicate, tapering-cylindric, the summit obtusely conic; thin; chestnut brown, paler near the apex, the surface somewhat shining and distinctly but not closely striate. Whorls slightly over 5, quite convex, the suture deeply impressed. The aperture is strongly oblique, rounded lunate. Peristome thin and simple, the basal and outer margins well arched; columella vertical with broadly dilated edge. The insertions of the lips are remote. The umbilicus is circular and deep. Length 1.8, diam. 1.36 mm.

Hawaii: Crest of the Kilauea crater, about a half mile south of the hotel. Types No. 91,699, A. N. S. Phila., collected by Dr. Benjamin Sharp. Cotype in the Bernice Pauahi Bishop Museum at Honolulu.

This species is closely related to the following, from which it differs in being somewhat larger but with a smaller number of whorls. The

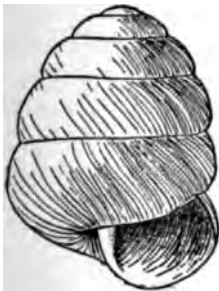


Fig. 1.

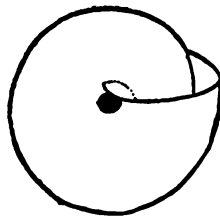


Fig. 2.



Fig. 3.

shape also differs perceptibly, *S. alexanderi* being noticeably more egg-shaped, with a rounded summit. It is also less strongly striate and

more polished. *S. sharpi* occurred with various species of *Tornatellina* and *Nesopupa*.

***Sphyradium alexanderi* C. and P., n. sp. Fig. 3.**

The shell is openly perforate, dextral, broadly ovate, subtruncate at the base, the apex blunt; nearly smooth, minutely striate especially below the sutures, shining, very thin, slightly diaphanous, chestnut, apical whorls much lighter; whorls  $5\frac{1}{2}$ - $5\frac{3}{4}$ , well rounded, increasing very slowly; sutures simple, well impressed. The aperture is oblique, quadrate-lunate; columella vertical, lip thin, reflexed at the columella, the margins remote; umbilicus circular, deep. Length 1.7, diam. 1.17 mm.

West Maui, at the top of Mt. Kukui, elevation about 6,000 feet.

This shell, in company with a species of *Tornatellina* and another of *Auriculella*, was found by C. M. Cooke, Jr., at the very apex of West Maui overlooking Iao valley. It was found only on low shrubs, two or three feet in height, at the base of leaves.

Collected in February, 1904. Type in Bishop Museum, M. P. 8. Cotype in A. N. S. Phila., No. 91,292.



## ADDITIONAL NEW SPECIES OF POLYCHÆTA FROM THE NORTH PACIFIC.

BY J. PERCY MOORE.

In the following pages are described a number of new species of Polychæta, belonging to several families, from the collections of the Alaskan Salmon Commission of 1903. Three papers noticing other novelties in these collections have already been published in these *Proceedings* with the approval of the Commissioner of Fisheries, through whose kindness the material was placed in my hands for study. The full report on all of the species represented will appear in the Bureau of Fisheries *Bulletin*.

*Notophyllum imbricatum* sp. nov. Plate X, figs. 1-3.

The two examples upon which this species is founded bear a remarkable resemblance in proportions and general aspect to a *Polynoe*. The body is depressed and the large, scale-like notopodial cirri are imbricated and, except for a short space near the anterior end, completely conceal the back from above.

The type and larger specimen is a trifle over 30 mm. long, and the greatest width between tips of the parapodia a little anterior to the middle of the body is 6.5 mm. The small individual is 12 mm. long and 1.8 mm. wide, and the back is concealed by the elytra even more completely than in the larger one.

The prostomium is flattened and wedge-shaped, with the slightly concave or straight base about two-thirds of the length, and the angles rounded. A slight emargination of the anterior portion of the sides is filled by an irregular low tubercle from which the frontal cirri arise. A pair of large brown eyes occupy the greater part of the posterior region of the prostomium laterad of the median tentacle (fig. 1).

The frontal tentacles arise in lateral and ventral pairs, the latter slightly in advance, from the slight emargination above mentioned. They nearly equal the prostomium in length, are stout and somewhat swollen above the base, and taper to fine tips. The median tentacle arises between the eyes and nearly fills this space. It is one and one-half times as long as the prostomium, stout and somewhat enlarged

above the base and tapers to a slender end. From behind its base a low ridge runs to the posterior margin of the prostomium. In both specimens the proboscis is retracted and the large mouth is bounded by a rather prominent lip, formed by the union of the peristomium with the succeeding somite.

The peristomium and two succeeding segments are much crowded forward so that the tentacular cirri arise beneath the head. The first or peristomial cirrus is a ventral cirrus and arises from the forwardly directed portion of the peristomium beneath the eye. It resembles the median cephalic tentacle in form and size, but is a trifle longer and arises from a distinct basal article. Arising from beneath the posterior dorsal margin of the prostomium, apparently from the peristomium, are three somewhat flattened appendages on each side, the outermost of which is the longest and connected with the corresponding tentacular cirrus by a slight web. The middle one is nearly as long, and the inner one is minute (fig. 1).

Somite II bears two pairs of tentacular cirri, a dorsal and a ventral one, separated by a considerable interval in which arises a small papilla probably representing a parapodium. The ventral cirrus occupies a position below the peristomial cirrus, which it resembles, but which it exceeds decidedly in both length and thickness. The dorsal cirrus of this somite arises at a higher level than any others in the body from beneath the postero-lateral angle of the prostomium, and its rather stout but long and tapering style reaches to IX or X. Somite III bears a dorsal tentacular cirrus only, which, with the complete parapodium to which it belongs, is depressed to a position more ventral than usual, in marked contrast to the dorsal cirrus of II. It arises from beneath and slightly behind the latter, which it resembles in form and size (fig. 1).

As stated before, the first three somites are carried well forward, the peristomium and II being coalesced ventrally but distinct, though very short, above. Remaining somites are well differentiated and obscurely biannular, the anterior and decidedly larger annulus bearing the parapodia. There are about 78 somites, the posterior end of the body being in a state of regeneration and the somites of that region as a consequence very small and tapered to a minute pygidium.

The body, excluding the parapodia, is slender, about two-fifths of the total width, and of nearly uniform diameter, except near the tapering ends. It is somewhat arched dorsally; flattened and with a shallow neural groove below.

Parapodia (fig. 2) are prominent and well developed throughout.

In the middle region they exceed one-fourth of the entire width. They consist of a broad base, a somewhat flattened, tongue-shaped neuropodium, slightly cleft at the tip and bearing a rounded and swollen prominence on the ventral side of its base, and a minute papilliform notopodium, which diverges dorsally from the neuropodium. Each division is supported by a single aciculus, the notopodial being very slender and curved, the neuropodial stouter and straight.

Along the posterior face of the base of the neuropodium above the papilla mentioned arises a flange-like ceratophore bearing a large, foliaceous palette-shaped ventral cirrus which curves upward behind the neuropodium and completely conceals both it and its setæ from behind. The notopodial ceratophore is very large, causing the notopodium itself to appear as a mere appendage. At its dorsal side the free distal border is prominently produced, thus prolonging the surface of attachment of the notopodial cirrus. The cirrus itself is very prominent, of a somewhat irregular reniform outline and attached by the marginal sinus. All of the notopodial cirri are turned nearly horizontally and overlap on the back in an imbricate fashion, closely similar to the elytra of the *Polynoidæ*. Anteriorly the dorsal cirri diminish in size so that they fail to cover the back completely and their ceratophores become more slender and elevated. The ventral cirri also become smaller, but remain prominent as far forward as III without essential change of form or position. A minute neuropodial tubercle exists on II, but it is uncertain if setæ are present thereon.

The eyes are purplish brown and the general color of the body a distinct dull greenish olive. Little pigment remains in any part of the body, but the notopodial cirri are more or less marked with dusky streaks and spots. A few small ova float free in the body cavity.

The notopodium usually bears but a single slender, curved and simple seta, and even this appears to be absent from several of the anterior parapodia. Neuropodial setæ are numerous, upwards of 20 to 30 occurring in the subacicular and 12 to 18 in the supraacicular groups. They are colorless and transparent, compound, with the stem gently curved and slightly enlarged at the end, where each side of the socket is provided with 6 to 8 very long, slender teeth and several shorter ones. The blade is slightly curved and tapers to an acute tip, and is striated and provided with minute marginal denticulations (fig. 3).

The only specimens are the two from Station 4,269, Afoqnak Bay, 14 to 19 fathoms, hard gray sand and rocks.

*Eulalia quadrioculata* sp. nov. Plate X, figs. 4-6.

This description is based upon a single much contracted entire specimen (type) and a fragment of the anterior end of another in every way similar.

The type is 27 mm. long, the protruded proboscis 2 mm. additional, the width without parapodia 2 mm., with parapodia 3 mm., the diameter of the distal end of the proboscis 2.5 mm., and the number of segments 106.

The evidently much contracted prostomium (fig. 4) is about two-thirds as long as wide, scarcely emarginated in the median line posteriorly, rather tumid in the posterior lateral part and then slightly concave to a small truncate median anterior lobe. The usual pair of eyes are transversely elliptical, situated on the dorsal surface of the prostomium about three times their diameter apart, nearly twice their diameter from the lateral margins of the head and not more than their diameter from the posterior margin. They have distinct lenses. In nearly the same transverse line or very slightly in advance and half way between the dorsal eyes and the margin, or just within the nuchal organs, is a second pair of eye-like spots of black pigment, but lenseless and smaller and more irregular than the dorsal eyes.

The four frontal tentacles are subequal, about as long as the head, and rather thick, with acute tips. The ventral pair project somewhat downwards, the dorsal directly outwards. From the middle of the small lobe lying between the frontal tentacles a shallow longitudinal groove passes to the median tentacle, which arises from a point just anterior to the eyes. It equals the frontal tentacles in length, but is slightly more slender in its distal part. The four tentacular cirri arise in the positions usual in the genus from somites I, II and III, and are short and subequal, being about twice the length of the prostomium.

The segments are all well differentiated and dorsally are strongly arched; anteriorly they are strictly simple smooth rings, but in the posterior third become biannulate. Ventrally the body is marked by a neural groove and lateral ridges bearing glandular areas ventral to the parapodia. On this surface the biannulation extends nearly to the anterior end. The anterior segments are contracted and extremely short, farther back they become relatively longer, and toward the posterior end the body is distinctly flattened. The pygidium, which is provided with a thickened welt-like rim surrounding the anus, bears on the ventral side a pair of prominent acuminate cirri resembling the ventral cirri in size.

Parapodia are located at the level of the ventral surface. That on

II, related to the second tentacular cirrus, is rudimentary and achæ-tous; that on III is larger, perfectly formed and bears setæ. The others have the form shown in fig. 5 and bear foliaceous dorsal cirri. When fully developed they are sharply marked off from the ventral glandular swellings by distinct lateral grooves. The notopodium is of course wanting, and the neuropodium is a small somewhat flattened process divided distally into a very small postsetal and a decidedly longer presetal lobe, from between which the single vertical series of setæ projects. Each lobe is notched on the edge at the point where the single straight slender aciculum reaches the surface. The neuropodial cirrus is prominent from III back and is a short, rather thick process attached to the posterior side of the base of the neuropodium. In the middle region it is somewhat foliaceous and reaches to the tip of the neuropodium; in form it is triangular with the broad, somewhat convex base ventral and the apex dorsal, while the attachment is by one of the short sides. Posteriorly they become more slender and project distinctly beyond the end of the neuropodium.

The dorsal cirri (fig. 5) are prominent and foliaceous throughout. They arise from stout bases situated a short distance dorsal to the neuropodia, which they in most cases exceed in size. All of the cirri have their fibrous and glandular structures arranged pinnately along an axial core. Anteriorly the cirri are rather broadly lanceolate with acuminate, somewhat recurved tips; posteriorly they become more slender and elongated; and finally are very narrowly lanceolate and of a length exceeding the diameter of the body. At the same time their foliaceous character is gradually lost.

About thirty setæ, equally divided between the supraacicular and subacicular groups, form the vertical fan-like fascicle. They are of the usual compound form (fig. 6) with the transparent, colorless stems rather stouter than those of *E. longicornuta*, the thickened and nearly truncate end furnished on each side with seven or eight slender teeth, one of which is much larger than the others. The blades are short, broad at the base, and rather conspicuously striated and fringed.

The type specimen, a female filled with large eggs, retains a dull olive color throughout the body, becoming brown on the dorsal cirri. Besides the black pigment in the eyes, there is a diffuse spot near the tip of each dorsal cirrus, and a very minute spot beneath each ganglion of the ventral chain. The cotype shows some indications of a faint transverse band across the dorsum of each segment.

The type and cotype are from Quarantine Rock, Port Townsend, Washington, June 27, 1903.

*Eulalia longicornuta* sp. nov. Plate X, figs. 7, 8.

A complete example, much contracted, measures 15 mm. in length, with a body width of 1.5 mm. at the widest part, and a total of 73 segments.

The broad prostomium is very slightly cordate, about as wide as long, and has no distinct concavity or constriction behind the frontal tentacles. The latter arise from the extreme anterior end of the prostomium, are slightly longer than the head and very slender. The median tentacle arises immediately in front of a line connecting the anterior border of the eyes or very close to the centre of the prostomium. It is  $1\frac{1}{2}$  times as long as the head, very slender, and tapers regularly from the base to the tip.

The single pair of eyes are circular, black, situated nearly their diameter from the posterior margin of the prostomium and twice their diameter from each other. Both specimens have the proboscis retracted, in which condition the mouth is bounded below by a somewhat swollen, longitudinally furrowed lip. The peristomial somite appears on the dorsum as a slightly elevated lenticular area overlapping the prostomium. The first ventral tentacular cirrus arises directly beneath the eye, the second one from somite II; both are slender and subulate and reach back to somite VII or to a length  $2\frac{1}{2}$  times the head. The two dorsal tentacular cirri arise from II and III respectively, and are about twice the length of the ventral cirrus, very slender and regularly tapered to a delicate tip.

Dorsally the body is strongly arched above, below flattened and slightly grooved. It is widest at the middle and tapers regularly and nearly equally both ways. The segments are well marked throughout and show scarcely a trace of biannulation, even posteriorly. The anal cirri are missing from both type and cotype.

Although the specimens are smaller, the parapodia (fig. 7) are even more prominent than in *E. quadrioculata*, owing to the projecting character of the dorsal angle of the presetal lobe, but otherwise they are similar. The dorsal cirri are, however, very different from those of that species, being folded against the sides of the body instead of held erect. They are strongly foliaceous throughout, the anterior and middle ones having a broadly pyriform outline, and those of the latter region being especially broad; the posterior ones are more slender and rather cuneate-ovate. Moreover, the central area is always broad and thick and the gland ducts and other markings radiate from it in all directions and not in a pinnate manner. The ventral cirrus is also prominent and projects beyond the dorsal lobe of the parapodium.

There are about 10 supraacicular and 12 subacicular setæ in all, but fewer on the extreme anterior and posterior parapodia and, except for the usual variations in relative length of the blade, all have the form exhibited in fig. 8. The slender stem ends in an acutely oblique enlargement with 7 to 9 nearly equal, closely appressed teeth on each side. The blades are slender, flexible and very acute, with very fine marginal fringe.

In both specimens the color has faded to a nearly uniform olive with some brown striations on the dorsal cirri. The type is a female filled with eggs. These specimens were found among serpulid tubes taken at the Quarantine Station dock near Port Townsend, Washington, on June 27, 1903.

*Plenosyllis magnifica* sp. nov. Plate X, figs. 9-11.

This large syllid is described from two specimens, one of which (the type) measures 48 mm. long and nearly 2 mm. wide, exclusive of cirri and setæ, in the middle of the body. The form is much depressed, especially in the widened middle region, from which it tapers to the very small head and pygidium.

As just indicated the prostomium is small, its width little exceeding three-fifths of the width of the second segment and one-fifth of the maximum breadth of the body. It is depressed, somewhat quadrangular in form, widest anteriorly where the width is about double the length. The somewhat flattened palpi project forward and somewhat downward and are very slightly connate at the base (fig. 9).

All three of the cephalic cirri are decidedly slender and arise in a transverse row from almost the extreme anterior margin of the prostomium. In one specimen they are subequal and about three times the length of the prostomium. In the other the median one is three and one-half times, the lateral about twice the prostomial length. The ends may be partly sloughed away.

The eyes, though small, are very conspicuous and nearly black, the anterior slightly the larger. Together they form a quadrate figure conforming to the outline of the head and about two-thirds as large.

Dorsally the peristomium is very short, but ventrally it projects as a prominent lip surrounding the large mouth. A fragment of the anterior end of an example of this species from Station 4,235 has the proboscis protruded as a short bell-shaped structure, bearing ten prominent papillæ at the end and just behind them a conical, dorsal median tooth which appears to be quite soft. On the roof of the pharynx just behind the everted portion there appears to be, however, a hardened, horny elliptical area. This specimen also has the eyes.

larger than the others and nearly connate, but no swimming setæ exist on any of the small number of anterior segments present.

Of the tentacular cirri (fig. 9) the dorsal peristomial is about four times as long as the prostomium, that of somite II is slightly longer and of III as much shorter; the ventral peristomial cirrus is about two and one-half times the prostomial length. All of the tentacular cirri resemble the cephalic cirri in being slender, delicate, and not moniliform, or with indistinct irregular furrows only.

After the second, the segments increase very gradually in length and more rapidly in width and soon assume the depressed form characterizing the middle region where they are five or six times as wide as long. The type specimen has about 150 somites, the cotype only 110. Posteriorly the body becomes slender and ends in a minute annular pygidium, bearing on its ventral side a pair of very slender caudal cirri equalling the last twelve segments and exceeding any of the cephalic appendages.

The parapodia are of the form usual in Syllidæ and project prominently from the sides at a low level. Although there is no distinct notopodium, a slender notopodial aciculus is always present just beneath the notopodial cirrophore (fig. 10). The well-developed neuropodium terminates in a broadly rounded, more dorsal, postsetal process and a longer, rather prominent, and more ventral presetal process. The three or four aciculi terminate at the upper outer angle of the former. Ventral cirri are always short, stout and bluntly rounded, with oblique bases passing into the ventral surface of the body, and in size about equal the neuropodia. Notopodial cirri arise from very large and prominent cirrophores. Except for their slightly larger size anteriorly, where they are about three times the length of the prostomium, the notopodial styles are similar throughout. They are probably somewhat contracted and in life would be longer and more slender. In the middle of the body they are scarcely one-half of the total width. As shown in the figure they are rather stout and coarse, and, though more or less deeply marked with irregular transverse furrows, are never regularly articulated or moniliform. The only variation in the parapodia is that they become more prominent in all their parts posteriorly.

Notopodial aciculi are slender, curved and acutely pointed; the neuropodial are stouter, nearly straight and knobbed at the end. All setæ (fig. 11) are compound and all are subacicular in position. In middle parapodia they are numerous, arranged in about ten horizontal rows of three to five each, or about forty in all. They are colorless,



with long, slender, curved shafts, the ends of which are rather abruptly enlarged and not very oblique, and are provided with only a few small teeth at the apex. The appendages or blades are strongly hooked and bifid at the end and distinctly fringed. The shortest posterior ones have a length of about one and one-third times the diameter of the end of the shaft, the longest about four and one-half times that diameter.

Both specimens are entirely colorless and the large one is filled with masses of sperm.

The type comes from Admiralty Inlet, near Port Townsend, Washington, Station 4,219, 16 to 26 fathoms, on a bottom of green mud with sand and broken shells. A fragment was taken at Yes Bay, Behm Canal, 130 to 193 fathoms, bottom of gray mud.

*Stauronereis annulatus* sp. nov. Plate X, figs. 12, 13, and Plate XI, figs. 18-22.

The larger example (much contracted) is 13 mm. long and about 1 mm. wide exclusive of the setæ, and has 72 segments. The other is 9 mm. long with 62 segments.

The prostomium (fig. 12) consists of a broad shovel-like anterior process and two short segments, each bearing a pair of tentacles and a pair of eyes. Although these two divisions or rings are about equal, both the eyes and tentacles of the anterior one are much the larger. The anterior tentacles (palpi) arise from the ventro-lateral region of the first annulus. Each consists of a large and very stout basal piece strongly curved backwards by the sides of the head and bearing on its end a very small ellipsoidal terminal article. Just above the base of each, on the dorso-lateral region of the head, is a large very dark brown eye. Immediately behind and slightly above the large eyes the second pair of tentacles are borne on the second annulus. They are about as long but not so stout as the anterior ones, are cylindrical in form and consist of six or seven nearly spherical articles. The second pair of eyes are minute dark brown spots about one-fifth the diameter of the anterior pair, and are situated on the dorsum of the second annulus about half as far apart as the anterior pair. The mouth is small and bounded behind by the second somite, and from it project the ends of the jaws (fig. 18). Owing to the retracted state of the proboscis the jaw apparatus is not all visible. A specimen cleared in glycerine shows on the dorsal side a lenticular area having a very dark brown border and a paler interior enclosing a small central space. In ventral view are seen the pair of dark brown mandibles (fig. 18) with slender bowed bases and curved, divergent, tapering end-plates bearing about seven strong teeth along the medial margin.

The prostomium and somite II are apodous, short simple rings. All others bear parapodia, but are not otherwise more complicated in structure. Up to about the fifteenth they increase in size, but remain uniannular throughout. The body is strongly arched above and nearly flat below, and terminates in a simple ring-like pygidium bearing a pair of small ventral anal cirri as long as the diameter of the pygidium.

Parapodia are small, slender and strictly lateral in position. Except that they correspond in size with the segment bearing them and are consequently largest at the middle of the body, they are quite similar throughout. The neuropodium (fig. 13) is slender, nearly cylindrical and slightly enlarged distally, where it terminates in a presetal lobe divided into a larger ventral and a minute acicular process, and a postsetal lobe which begins just below the aciculum and runs to a rather prominent dorsal angle. Its dorsal surface bears a group of long cilia. The neuropodial cirrus is a simple finger-like papilla arising in or near the distal third of the ventro-posterior surface of the neuropodium and reaching nearly to the end of the latter.

The dorsal cirrus arises immediately above the base of the neuropodium and consists of a slender, elongated cirrophore nearly as long as the latter and slightly diverging from it. Usually but not always it is slightly constricted about the middle and the end is a little thickened. Probably it represents the notopodium, as what appears to be a slender aciculus penetrates about half of its length. A tuft of long cilia resembling that on the dorsal surface of the neuropodium is usually present on its ventral and sometimes on its dorsal surface also. On the end of this basal piece is borne a terminal style of about half its length and of a slender, conical form. The first parapodium altogether lacks a dorsal cirrus.

Setæ are numerous and of four forms, all very delicate, transparent and colorless. They are arranged in well differentiated supra- and subacicular fascicles, each comprising two kinds, and all of which occur throughout the body, except perhaps in a few anterior segments, where the long compound setæ have not been found.

All of the supraacicular setæ are simple; those most numerous being very delicate but stiff capillary bristles, tapered to very acute tips, slightly curved and rather strongly serrated in an antrorse manner along one side (fig. 20). Their exposed parts are fully three times as long as the entire neuropodium. The other form has generally stouter stems, straight and tapering until near the end (fig. 19), where they present a gentle ventral curvature and at the same time become

broadened and end in two divergent, slightly curved points, the ventral of which is the longer; while below the dorsal is a serrated sheath, the rather coarse teeth of which are directed outward. Seldom more than three or four of the latter form occur in a parapodium along with ten or fifteen of the former.

Subacicular setæ are all compound. The most numerous kind occur to the number of about fifteen. They have moderately stout, rather strongly curved stems, the end being very unequally and obliquely bifurcated to form a socket, the dorsal border of which is provided with a few teeth (fig. 20), while the blades are comparatively short, but increase in length from the ventral to the dorsal margin of the bundle, and have one border fringed and the end terminated by a pair of distinct but not widely separated and nearly parallel teeth. The second kind of compound setæ (fig. 22) seldom exceeds three in number. They have the same construction as the more numerous form but are much more slender and delicate in all their parts, and the blade often equals the entire length of the neuropodium or about three times the length of the longest blades of the other type. On the most anterior segments the two forms appear to grade into each other. The setæ of this species differ decidedly from those of typical members of the genus and are more nearly like those of *Prionognathus ciliatus* Keferstein.

These worms are quite colorless and their form and histological structure indicates that they may be pelagic in habit.

The type and a somewhat smaller cotype were obtained at Quarantine Rock, Port Townsend, Washington, June 27, 1903.

**Notemastus giganteus.** Plate X, figs. 24, 25.

The only complete specimen measures 140 mm. in length and 7 mm. in maximum diameter in the thoracic region, but a second incomplete example is much larger. Even taking into account the contracted state of the specimens, this species is much stouter than usual for the genus. The body is nearly terete or slightly depressed and for the first fifteen or twenty millimeters increases in diameter, and then falls off to the posterior end which is two millimeters in diameter within ten segments of the anus.

The prostomium is a small rounded lobe bearing a minute conical palpode and is completely retracted within the peristomium, which, except in being slightly longer, resembles the immediately following segments. The protruded and collapsed proboscis forms a discoid, wrinkled structure fully 8 mm. in diameter. All of the thoracic seg-

ments are strongly biannulate, the anterior annulus being slightly shorter than the posterior. Each annulus is marked out in irregular areas, of which there is generally but one series to each annulus, though on somites IV to VII inclusive they become arranged irregularly in two rows. Behind VII the thoracic segments become smooth and more glandular and decrease in length, though even the last is fully one-half longer than the first abdominal.

Beginning with II, each thoracic segment bears small notopodial and neuropodial tufts of very delicate, narrowly winged capillary setæ in the usual positions, but neither the lateral sense organs nor the genital pores can be detected in surface views of these specimens.

The abdominal segments, of which there are 190, are very short, with shallow, ill-defined furrows, and are either simple rings or anteriorly obscurely biannulate. The surface is smooth, and the integument provided with a thick glandular coat on the anterior and a much thinner coat on the posterior segments.

The notopodial tori are very long, but not at all elevated above the surface in these specimens, and bear a great number of uncini. The notopodial torus is much more elevated and prominent, especially on posterior segments, but is much shorter and contains a much smaller number of uncini. The gills are low, rather long, inconspicuous folds. The pygidium forms a narrow circumanal welt bearing two longer prominently protruding ventral cirri and four much smaller ones in two pairs more dorsally placed.

The uncini (figs. 24, 25) are numerous and very delicate crochets of a peculiar form. They are f-shaped with the densely fibrillated core exhibiting a slight spiral turn, and the tip provided with a single bent terminal process, somewhat flattened and at the base swollen and over-arched by a depressed hood, the margin of which is denticulated with eight or ten teeth.

The type comes from Station 4,264, off Freshwater Bay, in Chatham Strait, at a depth of 282-293 fathoms, and on a bottom of green mud; the larger but incomplete cotype was taken at Station 4,197, in the Gulf of Georgia, at a depth of 31 to 90 fathoms, on a bottom of sticky green mud and fine sand.

**Travisia pupa** sp. nov. Plate XI, fig. 23.

This is a thick, stout, grub-shaped worm tapering nearly equally both ways but having the anterior end rather blunter and thicker. The considerable number of examples in the collection measure from 24 mm. to 82 mm. in length, with corresponding diameters at the middle of from 8 mm. to 32 mm. Exclusive of the pygidium there are thirty-

one or thirty-two somites, but the number is not correlated with the size of the worm, the largest two having thirty-one and the smallest thirty-two.

The prostomium is a minute conical organ, thin-skinned, weak-walled and hollow, and apparently capable of distention by internal fluid. It is followed by a short, uniannular segment continuing the general conical form of the anterior end. Dorsally this segment is crenulated on its posterior margin; below it is flattened and slightly grooved in the middle of the posterior part; and on each side it is provided with a dorso-lateral groove which terminates anteriorly in a deep sensory pit at the posterior margin of the prostomium. The next segment is biannular, with the anterior ring distinctly larger. Below it forms the upper lip and is thrown into a number of deep longitudinal folds and furrows which pass into the mouth. On each side, above a rather prominent swelling, is a quadrangular area opposite the groove on the first segment and itself bounded by a longitudinal groove above and another below, both of which cut the segment for its entire length. This area bears the small tufts of notopodial and neuropodial setæ and between them an elliptical clear spot or pit. Dorsally each ring is marked by longitudinal grooves which effect a peculiar lobed and crenulated arrangement of the posterior margin. The third somite is triannulate, but the anterior two rings are somewhat united and on the ventral surface the first enters the sides of the mouth and the second forms the longitudinally grooved lower lip. At the sides this segment is constructed like the second, except that the posterior third of the quadrate area is depressed and smooth and that a cirrus is borne on each side immediately above and behind the notopodial setæ. Above the same longitudinal sulcation and posterior lobing appear. The next twelve segments are formed of three equal rings completely separated by continuous furrows, except for the short interruptions at the setigerous areas on each side. Dorsal longitudinal sulcations are wanting and a second sensory pit, which first appears on the middle of the second ring below the setigerous area of somite IV, becomes very conspicuous on the posterior segments of this region, and on every specimen finally ceases on XV. Somites XVI, XVII and XVIII each consist of a large posterior and a small anterior ring, the furrow separating which becomes successively more and more restricted to the dorsal and ventral regions. Traces of a short anterior ring, differentiated only dorsally and ventrally, still continue on XIX and XX, but all remaining somites are strictly uniannulate with prominent overlapping posterior margins, which finally become telescopic. Somite

XIV, which is exactly at the middle of the body, is the longest; but the reduction in both length and diameter of the segments is slight until near the ends, where it becomes more rapid. The pygidium is a short squarely truncated tube marked externally by longitudinal grooves which correspond with the clefts between the nine to twelve uneven lobes into which its margin is divided.

The surface of the body is vesiculated or finely pustular in the following manner: Generally over the posterior half of the body, in all of the intersegmental furrows and on all except the most anterior setigerous areas, the pustules are very small and, though numerous, not crowded. In macerated specimens they are collapsed and appear as punctations. From the middle of the body they gradually increase in size forward. Each annulus of anterior somites is provided on its highest part with an irregular transverse series of very large vesicles which usually lie nearer to the posterior margin and overlap the succeeding ring, when the worm is contracted, as a rough and irregular fold interrupted in the median dorsal region. These folds and their vesicles are usually best marked on the middle ring of each somite, on which they increase in prominence from the median break laterally to the setigerous areas, below and even more above which they form rough lobes overlapping the third ring. The ventral lobe bears the ventral sensory pit referred to above. Anteriorly the transverse series of enlarged vesicles tends to form several rows and all of the vesicles to increase in size. The first three segments bounding and anterior to the mouth are covered nearly uniformly with vesicles of moderate size; and similar ones cover the anterior two-thirds of the setigerous areas of the first ten or twelve segments. The prostomium is perfectly smooth and lacks surface vesicles altogether. Posteriorly the ridges of enlarged vesicles and the lateral lappets become gradually flattened out and the entire surface much smoother. The lappets above and below the setigerous areas remain, however, and may become even more prominent on the last few segments, where, however, they are not vesicular.

Neuropodial cirri appear on III and continue on every segment to near the posterior end, ceasing on from XXIV to XXVII in different specimens. They arise at the dorsal margin of the setigerous area, chiefly from the third annulus but in part from the second also. At the base their diameter nearly equals the length of the third annulus, but they quickly become slender. The surface is strongly wrinkled transversely, much like the contracted tentacle of a jelly-fish, and doubtless they are in life capable of great extension; but in the preserved speci-

mens, even where longest (in the middle of the body), they barely equal one-half or one-third of the body diameter. Toward the ends they are reduced to one-third or even one-fourth of this length.

Lateral sense organs appear as a pair between the prostomium and peristomium and occur between the setæ tufts of every succeeding segment, except that they are occasionally absent from XXXI or XXXII. In shape they are elliptical with the long axis vertical. Ventral sensory pits appear on IV and continue without exception to XV in the position indicated above. At first very small, they increase rapidly until they exceed the lateral organs, unlike which they are always circular.

Small notopodial and neuropodial tufts of setæ occur on all somites from II caudad at the junction of the second and third rings. Both tufts are retractile into pits and the notopodial setæ are somewhat longer than the neuropodial. All setæ are very slender, flexible and thread-like, of various lengths in each tuft, and have each margin provided with a fringe of appressed hairs.

Many of the specimens are enclosed in a very tough mucous membrane more or less coated with silt, and often inhabited by small nematodes.

This species bears much resemblance to *Travisia olens* Ehlers, which has only thirty segments and rather distinct parapodial papillæ.

It is apparently an abundant worm, conspicuous from its large size, and widespread on muddy bottoms. Specimens were collected from the following stations: 4,192, Gulf of Georgia, 18 to 23 fathoms, green mud and fine sand; 4,194, Gulf of Georgia (type locality), 111 to 170 fathoms, soft green mud; 4,197, Gulf of Georgia, 31 to 90 fathoms, sticky green mud and fine sand; 4,230, Behm Canal, 108 to 240 fathoms, rocky; 4,235, Behm Canal, 130 to 193 fathoms, gray mud; 4,237, Behm Canal, 192 fathoms, green mud; 4,246, Kasaan Bay, Prince of Wales Island, 101 to 123 fathoms, gray and green mud, coarse sand and shells.

*Brada pilosa* sp. nov. Plate X, figs. 14-17.

This well-marked species is represented by about a dozen specimens varying in length from 15 to 30 mm., the largest having a maximum diameter of 5 mm. With the prostomium and tentacles retracted, which is the condition of all of the specimens, the form of the body is slender clavate, bluntly rounded at the anterior end and gradually thickening to about XI or XII, from which point it tapers into the rather slender, gracefully formed caudal region.

The exact form of the prostomium and mouth is not apparent, inasmuch as this region is retracted, leaving a conspicuous trifid opening which has been sometimes indicated in descriptions of other species as the true mouth. In this condition the peristomium is trilobate. All of the segments are simple rings, separated from one another by clearly defined but not conspicuous intersegmental furrows which become more distinct posteriorly. The segments pass regularly into one another without any conspicuous breaks in contour, and increase in length, as they do in diameter, to about XII, then undergo little change to the middle of the body, behind which they become again gradually shorter. Toward the posterior end they diminish to a minute pygidium which contains a small, vertical, slit-like anus, but appears to lack cirri or other appendages.

The number of segments varies from 31 to 33, the latter number being present in the type. All, including the peristomium, bear both notopodial and neuropodial setæ in tufts upon minute tubercles.

The chief characteristic of the species is the richness of its papillation. The entire dorsal surface is thickly covered with filiform papillæ especially numerous toward the ends, where they are so densely arranged that they actually touch and crowd one another. On the middle segments they are more widely separated, but are still so numerous that where *Brada villosa* bears 3 or 4 in the length of a somite, this species bears 8 to 12. They are not disposed in regular rows, but are arranged more or less irregularly at nearly equal intervals in all directions. The intersegmental furrows lack papillæ and appear as smooth lines, like narrow avenues through a grass field. Just anterior to each parapodium the papillæ become few or nearly disappear, leaving a wider open space at this point. Those papillæ remaining in this region are collected about the setigerous tubercles, but instead of becoming enlarged and forming rosettes they are actually smaller than the dorsal ones.

All of the papillæ (fig. 14) are slender, elongated and filiform with a small terminal knob. Many of them collect a thick girdle of sediment in a zone near the base, which gives the appearance of a bulbous enlargement. They differ considerably in length and toward the anterior end of the body exceed the length of the segment bearing them, so that this region has the appearance of being thickly coated with fine hairs. At the level of the ventral margin of the neuropodial tubercles the dorsal papillation ceases abruptly, and is replaced by the much smaller papillæ (fig. 15) which cover this surface. Although their number is nearly as great, these papillæ are so much smaller than



those found on the dorsal surface that to the naked eye they appear merely as a fine granulation.

Every somite, including the peristomium, bears both notopodial and neuropodial setæ in small lateral tufts. The setæ of both fascicles have the same character, all being slender and transversely jointed, except at the acutely pointed tip. The former (fig. 16) are very slender and delicate and the internodes increase in length toward the tip. The latter (fig. 17) are more deeply colored, much stouter, distinctly curved and the much shorter joints decrease in length toward the tip. In both tufts the number of setæ is small, about eight notopodials and eight or ten neuropodials being the rule. On the peristomium the notopodials are very long, equalling four or five segments, and they project forward far beyond the mouth. On succeeding segments they project outward and upward and decrease in length until they are about equal to the segment bearing them. The neuropodials are rudimentary on I, but increase in both length and thickness on succeeding anterior segments, those at the posterior end becoming again more slender but without diminution in length.

As stated above the prostomium is in all cases retracted. A dissection shows that the tentacles are fine and very numerous, numbering upwards of thirty on each side. They are borne on a pair of bosses which are about twice as wide dorsally as ventrally, where they curve around the mouth and nearly meet. The palpi are very short and broad and marked by a longitudinal groove and transverse wrinkles on the ventral side, the dorsal surface being smooth. The skin is gray, but the papillæ impart to the dorsal surface a buffy yellow color.

*Brada pilosa* very closely resembles *Trophonia hirsuta* Theel, but is distinguished by the reduction in size and number of the papillæ forming the setal rosettes and by the unjointed tip and other peculiarities of the setæ.

The species is not uncommon northward. Examples occur from the following stations: Station 4,251 (type locality), Stephens Passage, 198 fathoms, rocky bottom; 4,235, Yes Bay, Behm Canal, 130 to 193 fathoms, gray mud; 4,252, Stephens Passage, 198 to 201 fathoms, gray mud; 4,258, Lynn Canal, 300 to 313 fathoms, mud.

***Maldane similis* sp. nov.** Plate XI, figs. 26-30.

The type and largest example is 56 mm. long and 2.5 mm. wide, the latter being nearly constant throughout the entire length.

This species belongs to the *M. biceps* group in having the cephalic and caudal plates of nearly the same form and size. The cephalic plate

is very broadly elliptical in outline, the margin little limbate, the posterior two-fifths separated by a deep notch on each side from the anterior three-fifths, the former erect and with its margin finely denticulated with from twenty to twenty-five teeth. One-fourth of the remaining margin anterior to the notch forms on each side a rather thick, narrow, spreading rim, the margin of which is quite entire or merely slightly crenulated, not conspicuously toothed as in *M. biceps*. Anteriorly the cephalic rim is separated from the postero-lateral margins of the palpode by a pair of distinct radial furrows. The palpode is very large and contributes easily three-tenths of the entire margin. It is very broad and flat, with a smoothly curved anterior border and rather more than one-third of the middle of its posterior border produced backward on to the head plate as a slightly elevated median welt scarcely rising to the height of a ridge. On each side of this, forming its lateral boundaries and the posterior boundary of the lateral portions of the palpode are the deep sensory slits, U-shaped or hooked, with the lateral limb the shorter. No furrows or other markings occur on the surface of the cephalic plate.

The mouth is large and the lips prominent and pouting. A short distance behind it is a transverse groove encircling the ventral half of the peristomium and joining a conspicuous longitudinal groove which begins at the lateral notch in the cephalic margin and passes along the side of the peristomium, to end posteriorly in the circular furrow which separates a complete narrow ring from the hinder part of the segment. Inasmuch as the posterior part of the peristomium is retracted within the anterior margin of II, this ring is completely concealed ventrally by the prominent half-collar developed in that position on the latter segment.

The next segment (II) is very short, its length not more than one-half of its diameter; the posterior third is completely separated as a distinct ring; and the anterior margin is somewhat produced into a collar, the ventral half of which springs into especial prominence abruptly at the level of the setæ. Somite III is about one-third longer than II and similarly biannulated, but its anterior margin is not collared. Thus far the skin is entirely glandularly thickened.

The following six segments (IV to IX) are decidedly longer, about equalling their own diameter, and the secondary furrow, while always present, is in a more anterior position not far behind the middle. While the three anterior segments are glandular throughout, the ones under discussion have the glandular area confined to the ventral half of the body and especially to the anterior ring in the vicinity of the

tori. Somites IX and X are indistinguishable, and on the latter the now prominent tori have shifted to the posterior end of the segment.

From this point the segments continue to lengthen to XIV, which is about three times as long as thick, after which they again decrease. Throughout the middle region the integuments are soft and translucent, except for the swollen, oval, glandular areas surrounding each torus. Somites XVIII, XIX and XX are again much thicker than long and the tori are correspondingly large and prominent; XX is about one-fourth as long as thick with a prominent pair of achæitous tori much below the usual level and meeting ventrally.

The pygidium consists of a very short basal ring bearing a pair of coalesced glandular thickenings corresponding to the tori of XX. The anus is conspicuous and in a dorsal position at the base of the dorsal membrane. The limbate margin of the pygidium bears a remarkable resemblance to the cephalic plate, but is oblique in a reverse direction. Its ventral two-fifths are separated from the dorsal three-fifths by a deep rounded notch, with thickened margins which nearly meet externally and constrict its opening. The ventral portion has its margin marked by four very broad, shallow crenulations and a pair of prominent triangular lateral lobes. The dorsal plate is more prominent and flaring, with a smooth and regular margin marked only by a broad and extremely shallow median emargination.

Somites I and II and the pygidium are achæitous; II bears strictly lateral setæ only, arranged in a vertical tuft just above the dorsal ends of the ventral collar; III and IV bear similar setæ tufts and very short series of uncini disposed in the same plane and both strictly lateral and sessile. On succeeding segments the setæ tufts have short, slightly oblique bases placed a little in advance of the uncini, which form lines five or six times as long as those on the preceding somites, more ventral in position, and elevated upon distinct tori. Proceeding caudad the uncinal lines increase slightly in length and become more ventral in position. The number of uncini in a torus is about 8 on III, 13 on V, 28 on X, 32 on XV and 35 on XIX.

The small tuft on II contains setæ of two kinds, the one small with a rather wide wing and abruptly tapered stem terminating in a slender tip; the other very much longer, with the stem conspicuously striated the tips rigid and less slender and the wing very narrow (fig. 26). On following somites the number of setæ increases to 10 or 12 pairs, the larger ones become stouter and the smaller more slender. By somite XV the number is further reduced; the small setæ exhibit only minute pointed tips and the ends of the larger ones are elongated and

provided with ensheathing awns which appear to be disposed in symmetrical pairs.

Anterior uncini (on III) (fig. 27) have the head little enlarged and somewhat thrown back, the stout, blunt, nearly straight beak somewhat elevated, the crest composed of a single large tooth with a cluster of small ones surrounding its base, and the guard rudimentary or absent (fig. 28). In a succeeding tori there is a gradual transition to the typical form which appears at about VI. Such uncini (fig. 29) have a distinct shoulder, well-defined neck and head, and a stout, tapering, hooked beak with an acute, slightly recurved tip. The crest is well developed and formed of two transverse rows of numerous teeth which are largest at the vertex and become rapidly reduced laterally. The guard is strong and arising well below the beak sweeps boldly beyond and above its tip (fig. 30).

The type and one other specimen were taken at Station 4,264, off Freshwater Bay, Chatham Strait, 282 to 293 fathoms, on a bottom of green mud.

***Maldanella robusta* sp. nov.** Plate XI, figs. 31, 32.

No complete specimen of this species occurs in the collection, but fortunately there are several heads and one posterior end and it is possible to so fit the fragments together as to secure a complete description.

The worm thus reconstructed is a fine large one, measuring about 195 mm. long and 7.5 mm. in diameter at the middle part. Excluding the pygidium there is twenty-one segments, of which the peristomium and first preanal segment are achætous, II bears setæ only, XX setæ only on one side, and III to XIX inclusive both setæ and uncini.

The prostomium and peristomium are completely coalesced and exhibit no trace of a dividing furrow or suture. The cephalic plate meets the dorsal profile of the peristomium at an angle of approximately  $135^{\circ}$  to  $150^{\circ}$ , so that the ventral length of the head is nearly or quite twice the dorsal. The cephalic plate has a nearly regular ellipsoidal outline, with a length of about twice the width. Its thin margin is elevated all round, highest and most erect behind, thence slightly diminishing in height to a point anterior to the middle where it is folded and sometimes slightly notched. Anterior to this point it again becomes higher and more flaring until it curves into the base of the palpode, from which it is separated by a slight cleft. Except for a faint crenulation, the margin is entire. The median ridge is rather broad and low, but extends through the anterior half or less only of the

cephalic plate, ending abruptly behind; anteriorly it widens slightly and passes partly into the marginal rim, partly into the palpode. On each side of the ridge are deep sensory slits which anteriorly bend somewhat sharply outward and backward, and continue along the base of the lateral fold nearly as far as the posterior end of the median limb.

From near the posterior end of the median ridge to the lateral fold or notch in the marginal membrane passes a strictly transverse furrow on each side, leaving an extensive area in the posterior region of the head marked only by a few crescentic furrows parallel with the posterior margin. The palpode is a short, broadly rounded, rather thick, tongue-like structure which is continued backward on the ventral side as a broad welt to the mouth, within which it bifurcates to form a pair of ridges separated by a deep cleft. The mouth is relatively small and bounded by a nearly circular fold, elevated and furrowed somewhat like a piece of rope and which is open only anteriorly to admit the posterior extension of the palpode.

As before mentioned there is absolutely no visible line of separation between prostomium and peristomium, but the two together constitute a continuous head, shaped somewhat like a horse's hoof; that is, it spreads anteriorly, where it is truncated obliquely by the cephalic plate. The seven somites next following are cylindrical, with a nearly uniform diameter about equalling the posterior diameter of the peristomium, and a length but little greater. All have traces of anterior collars, which are best developed on IV to VII, on which also the glandular layer of the skin is thick and extensive. The skin of the head and somites II to IV is very smooth, iridescent and marked by fine furrows crossing in various directions, like those on the human skin. Somites V to VIII are of a dull, opaque, non-iridescent white. Following this the body is distinctly depressed and the segments elongated to two or three times their diameter. They bear prominent tori situated along broad elevated longitudinal muscle bands. While the greater part of the surface of the segments is smooth and has a conspicuous bluish iridescence, the longitudinal muscle ridges are vertically furrowed and, when the segments are much contracted, these furrows are extended nearly around the segment. With the exception of  $\frac{IX}{X}$ , the segments bounding which are continuous and the place of transition of the parapodia from an anterior to a posterior position, all of the furrows are well developed. Somite IX is the last exhibiting a distinct glandular region, which is confined to a narrow anterior zone. For nearly the entire length of the worm there appears in the median ventral line a neural cleft in the muscles, having

the aspect of a clear, translucent, bluish line. There is no diminution in the length of the posterior setigerous segments, but the achæitous segments are considerably reduced in both length and diameter. They are terete, about twice as long as thick, have the surface deeply wrinkled transversely and bear rather prominent tori in the posterior one-third. Following these is the campanulate pygidium which has a narrow ringed base and a deep cup-shaped body, the margin of which is divided into thirty-nine very regular bluntly rounded teeth, the four ventralmost of which are considerably broader than the others, while at three other points one of the latter has been replaced by two smaller ones. Both without and within the surface of the cup is longitudinally fluted, and in the deeper part of the interior numerous fine ribs, usually two to each marginal tooth, pass to the margin of the very large anus.

Somite II bears capillary setæ only, which arise as a narrow vertical tuft from a slit-like cleft into which they are retractile. Succeeding segments, to XIX inclusive, bear both setæ and uncini which are strictly lateral in position, the dorsal interval between the setæ scarcely exceeding the ventral interval between the uncini. As far as somite VIII the setæ continue to occur in the form of vertical tufts retractile within slit-like pockets; and the uncini, which begin immediately below the setæ and lie in the same plane, form strictly linear series sessile or even depressed below the surface. On IX and all subsequent segments the setæ are situated on rather prominent wart-like papillæ in the form of crescentic tufts open below; and the uncini are elevated on the crests of swollen tori. On II, III and IV the parapodia are situated in the anterior one-third; on V and VI they are but little anterior to the middle; on VII, VIII and IX they are again near the anterior end; on X they shift abruptly to the posterior one-third and so remain to the last. The posterior tori are especially prominent. Whether XX is normally setigerous cannot of course be determined until additional specimens are known.

The number of uncini increases toward the posterior end, the counts being 22 to 26 on III, 35 to 42 on V, 45 to 50 on X, 53 to 57 on XV and 60 on XIX.

The setæ are numerous and form dense tufts. On II those of one series are shorter and about three times as thick as the others and have well-developed wings. Those in the other series are slender and nearly wingless. On succeeding somites all of the setæ become much more elongated and more slender, but do not differ otherwise, and apparently lack altogether any lateral hairs or awns.

As indicated above uncini (fig. 31) are numerous on all segments;

and are stout, striated, and of a deep yellow color throughout. They differ very little in form on the different segments, the only noticeable distinction being that the extreme anterior ones have the crest teeth less well developed and the guard hairs fewer. The rather long, slender, curved stem has a distinct but tapering shoulder, a rather long, erect neck and an enlarged head, below which is a very prominent square guard process (fig. 32). The beak is stout and hooked, the crest teeth three or four, the lowermost very large, the upper small or obsolete; sometimes, especially on anterior uncini, a pair of small but distinct lateral teeth is present. The guard is strong and consists of about sixteen stiff hairs which arise from a scale-like base ensheathing the front of the guard process, and spread regularly in an even curve around the end of the beak, above which they arise convergingly to a considerable height.

The body of the alcoholics is generally colorless or pale yellow, but the cuticle has a strong bluish iridescence throughout.

A portion of a tube is soft and flexible, consisting of a thick mucoid substance covered with a stratum of moderate thickness of soft grayish brown silt.

This species is evidently related to the three species of *Maldanella* described by McIntosh from the deep waters of the oceans of the Southern hemisphere. The Japanese maldanid *Clymene harai* Izuka (= *Axiotea campanulata* Moore) also belongs to this genus.

The sources of the examples of *M. robusta* are Station 4,197, Gulf of Georgia, 31 to 90 fathoms, bottom of sticky green mud and fine sand; Station 4,230, Behm Canal, 108 to 240 fathoms, rocky bottom; and Station 4,246, the type locality, Kasaan Bay, Prince of Wales Island, 101 to 123 fathoms, bottom of green mud with coarse sand and shell fragments.

*Olymenella tentaculata* sp. nov. Plate XI, figs. 33-35.

This very interesting species is unfortunately imperfectly known, the following description being based upon one anterior and one posterior piece which may be parts of the same individual and which together represent nearly an entire worm.

The former measures 22 mm. long and 2 mm. wide at IX and consists of the prostomium and nine segments; the latter is much twisted and the five setigerous segments, four achæitous preanal segments and pygidium measure about 20 mm. long.

The cephalic plate is very much expanded and flares widely at the margin. Its outline is very broadly oval. The hinder third of the rim is separated from the anterior two-thirds by a pair of small lateral

incisions, behind which it is more erect and diminishes in height to a minute median posterior notch. Anterior to the lateral incisions the rather abruptly widened and flaring margins continue undiminished almost to the palpode which they join on each side. The cephalic margin is everywhere smooth and its margin entire. A pair of conspicuous sensory slits divide the central disk of the head for about the anterior five-sixths of its length into three narrow longitudinal areas of equal width which are united behind. The central one is somewhat ridged and widens almost imperceptibly as it passes into the palpode anteriorly. The palpode consists of a short rounded base bearing a slender, elongated finger-like process on its median anterior margin.

The cephalic plate forms a dorsal angle of about  $120^{\circ}$  or less with the peristomium, which is indistinguishably coalesced with the prostomium. It is little more than one-half as long as the cephalic plate and its surface is slightly granulated but unwrinkled. Owing to the protrusion of the proboscis, which has a depressed acorn-shape, with the basal division thickly papillated, the mouth is invisible.

Somite II (the first setigerous) has a length about equalling the width at the anterior end, from which it gradually diminishes in diameter caudad. The next two segments are narrower, after which the diameter increases gradually to VIII, though the length remains nearly constant; IX has the same diameter, but if complete is scarcely half as long as VIII. All of these segments are transversely wrinkled superficially and are provided with a distinct, raised neural line. No prominent collars but merely a low free rim, most distinct on V, are developed on their anterior ends.

Owing to the much coiled and twisted condition the real proportions of the distorted posterior segments cannot be easily ascertained. They are evidently three or four times as long as wide, slender and thin-skinned, except posteriorly where the prominent, swollen and glandular parapodia are developed. There are no especially developed glandular zones or muscular ridges and the neural line is elevated throughout. The last six or seven segments decrease in length and the entire region tapers to the pygidium. The first of the posterior achaetous segments is about one and one-half times as long as wide and of a shape similar to those preceding it, having fully developed but naked tori on the posterior end. The next three are simple rings without tori and of rapidly decreasing length. Terminating the body is a remarkably small, top-shaped pygidium lacking any limbate margin. Instead there arises around the base of the anal papilla, which con-



stitutes its greater part, a circle of twenty-three separate and distinct cirri, all of which are slender, regular and equal, and not, as in many species of the genus, alternately longer and shorter. Apparently they increase slightly in size from the dorsal to the ventral side; and the median ventral one is much elongated, its length equalling that of the four achætous segments combined or about ten times the length of the other marginal papillæ, and it is very slender distally.

On the first three setigerous somites (II to IV) about thirty setæ occur in each group and are disposed in small vertical tufts just above the lateral line and about one-third of the length of the somite from its anterior end. The small number of uncini (3 to 5) are sessile in short, transverse lines just below the setæ. On succeeding segments the setæ are more numerous and project upward and outward in tufts from small tubercles. The uncini are more numerous (13 on V, 20 on IX, and still more posteriorly) and form longer lines widely separated below by a space of twice or more their own length. The tori have become prominent swellings. On IX they have become transferred to the posterior end, although the boundary between this segment and VIII is not clearly defined. This condition of the tori continues throughout the body, though they become even more prominent posteriorly and are united across the dorsum of each segment by a glandular band. The dorsal interval between the setæ is about equal to the ventral interval between the uncini. The first achætous segment at the posterior end bears a pair of perfectly normal tori, but no setæ or uncini.

The setæ are often imperfect and their distribution is worked out only incompletely. Anterior segments have them all slightly curved, delicate and narrowly winged, with very slender, tapering tips. They occur in two series, one of finer, the other of coarser setæ. Farther back these two kinds become further differentiated. Both become longer and the slender ones provided with short basal wings, beyond which is a delicate capillary tip doubly fringed with strongly divergent, very fine hairs.

All uncini are yellow and have the stems longitudinally striated. Those of somites II to IV, in which the number is small, have the form shown in fig. 33. The stems are slender, slightly curved, regularly enlarged, but with no distinct nodulus, then slightly constricted to a neck, bearing a scarcely enlarged head (fig. 34), with a simple, tapering unhooked beak, a small crest of three minute teeth and apparently no guards. These uncini increase regularly to the dorsalmost, which

also has by far the most prominent beak. On the remaining somites the uncini differ decidedly in the form of the head (fig. 35) which is much enlarged backward. The smaller beak is more curved and hooked, the crest high and prominent, with five or sometimes six non-fibrous, imbricated teeth of diminishing size. The guard consists of several (about 8) fine tapering hairs, which arise from a plate just beneath the beak, the inferior outline of which they follow to the tip, above which they then rise as curled inarched filaments.

The alcoholic specimen is colorless, but the greatly developed parapodial plexuses of bloodvessels indicate red bands during life.

Some fragments of tubes are 3 mm. in diameter. Their flexible walls are composed of a soft mucoid membrane covered with a thin coating of very fine neatly deposited sand.

This species presents interesting resemblances to *Praxilla gracilis* (Sars) Malmgren in the form of the head and tentaculiform palpode, to *Clymenella catenata* (Malmgren) in the number of achæitous preanal somites, and to *C. rubrocincta* Johnson in the elongated median ventral pygidial cirrus.

It is known only from Station 4,264, off Freshwater Bay, Chatham Strait, July 25, 1903, 282 to 293 fathoms, bottom of green mud.

*Nisomache carinata* sp. nov. Plate XI, figs 36-39, and Plate XII, figs. 43 and 44.

A well-preserved but somewhat contracted specimen (the type) is 65 mm. long and 3 mm. in diameter at the thickest part. Another incomplete but more fully extended example must have exceeded twice this length when complete.

The prostomium and peristomium are coalesced, forming a continuous head about  $1\frac{1}{4}$  times as long as wide. The prostomial region is nearly vertical with about its medial  $\frac{1}{3}$  formed by a ridge, which forms a prominent profile, somewhat arched above and ending below and anteriorly in a transverse crescent, separated by a slight groove from the short, somewhat thickened palpode. The latter is continuous with the similarly thickened lateral margins of the head, within which is a pair of shallow longitudinal depressions, while within these again and close to the median ridge are the distinct longitudinal sensory slits or nuchal organs.

The dorsal peristomial region is somewhat tumid anteriorly, with a nearly straight profile posteriorly, but strongly arched transversely throughout. From the prostomium it is slightly distinguished by a faint transverse groove which passes laterally into the depression mentioned above and the groove which continues the latter posteriorly to the end of this segment. The mouth is a large elliptical opening sur-

rounded by a rugous, furrowed lip. Just behind this lip is a shallow transverse ventral groove, while near its posterior end this segment is completely encircled by another faint furrow which, like the groove mentioned, is met by the longitudinal furrow on each side.

Besides the pygidium the type has 24 segments, while the only other complete specimen in the collection has 25. The peristomium is achætous, and somites II to XXII (or XXIII) inclusive are setigerous, leaving two preanal achætous segments, as in *N. lumbricalis*. Somite II is as long as the head; the next seven or eight segments are successively of slightly increased length, the last named being nearly twice as long as the first. Behind IX several segments remain nearly equal in length, then the length diminishes, at first slowly, then rapidly to the last, the last three setigerous segments each equalling III in length and the two achætous preanal segments together barely exceeding the last setigerous. Somites II, III and IV are of much greater diameter anteriorly, and slope to the posterior end which is inserted slightly into the next succeeding segment. The next five segments (V to IX) are more nearly cylindrical, but bear slightly produced glandular collars at their anterior ends. The last four are simple short rings. At the two ends of the body the intersegmental furrows are deep and distinct, but in the middle region they are obscure.

The pygidium is funnel-form, but little widened, regular and somewhat longer than the last two segments combined. On the type its margin is divided into twenty-one equal and regular triangular teeth each with a minute cirriform tip. The only other anal funnel present has but sixteen marginal teeth and cirri. The anus is central and very large, and is surrounded by about ten regular lobes separated by as many radiating furrows. At about somite VIII the neural groove begins to be distinct between the lateral muscle ridges and continues to XXIV, from which point a faint neural line continues across the pygidium to end in the median marginal tooth which is narrower than the others. The other anal funnel has the three median ventral teeth smaller and the nerve cord terminating between two of them.

No distinctly elevated tori or setigerous tubercles exist anterior to XIII, on which the latter are midway between dorsum and venter, and the ridge-like tori extend from just below them through the centre of the broad glandular zone nearly to the neural line. On succeeding segments they are even more prominent, and behind XV have shifted with the glandular zone to the posterior end of the segment. Toward the posterior end as the thin-walled portion of the segment diminishes in length they become more central, and finally on XXI and XXII the

swollen glandular tori form the entire length of the segment and bear the uncini along the middle. Although XXII and XXIV are achætout they are similarly constituted.

The head and first four segments are very smooth, iridescent and of a uniform deep purple color above. The next three segments are smooth and dull yellowish throughout; those of the middle region have pale anterior glandular zones, the rest being yellowish and roughened, while posterior segments are pale throughout and thin-walled, except for the ventral longitudinal bands and posterior glandular zones.

The peristomium and two preanal segments are achætout. Somites II, III and IV have a single stout spine situated at about the end of the anterior one-third of the segment and about twice as far from the dorsal as from the ventral median line. A little above and in front of this is a short vertical series of capillary setæ. On the remaining segments the setæ form more prominent tufts arranged in vertical series midway on the sides of the body and in the middle of the glandular area which lies on the anterior end of the somites as far as about XV, then for some segments on the posterior end, and finally, with the disappearance of the non-glandular region, occupies the entire segment. Uncini occur on all segments from V to XXII inclusive. They are in all cases arranged in a single series in the same plane as the setæ, and extend in a line, for a greater or less distance according to their number, on to the ventral surface. On the anterior segments they are slightly larger and fewer, the number counted in the type being 7 to 9 on V, 16 to 19 on X and 10 to 12 on XXII.

The single ventral spines on II, III and IV are stout, fibrous and yellow, tapering to a slightly curved, blunt, hard point. On the same segments the notopodial tufts contain about six longer, stouter setæ (fig. 44) with longitudinally striated stems tapering to stiff, straight, acute tips and provided with a broad and extensive wing on one side and a very narrow one on the other; also a corresponding number, arranged in a parallel row, of much shorter, more delicate setæ (fig. 43) with nearly wingless stems tapering to a long hair-like and very delicate, flexible tip provided on each side with minute cilia-like hairs. The latter are so minute that they are visible under high powers only. Except for a slight increase in number the stouter setæ remain unchanged throughout, but the more delicate ones become considerably modified. By about the tenth segment they have become more numerous; some of them (fig. 43) are only moderately elongated (about as much or only slightly more than those of the preceding segments), but the lateral processes have become much larger, ensheathing and awn-

like, and may be arranged spirally (fig. 43a); others are very greatly elongated, thread-like, openly spiral, tapered very gently to acute tips, and have the lateral processes reduced to minute appressed scales (fig. 36). The latter spring in a group from the ventral side of the bundle.

Typical crochets (figs. 38 and 39) have rather slender, strongly curved stems with an asymmetrical nodulus near the middle, the head very little enlarged and provided with a stout, rather long, moderately acute, strongly hooked, and slightly recurved rostrum, above which is a prominent crest consisting of five, or sometimes of four, depressed, overlapping, diminishing teeth. There are no lateral teeth, but the striations end in several groups of conspicuous markings just below the principal teeth. The guard arises close beneath the rostrum, but separated from the latter by a distinct space. There is no distinct guard process or shoulder, but the guard arises as a distinct transverse plate, soon becoming divided into about twelve slender, tapering filaments, which spread around the end of the rostrum or overarch it. The stem, neck and posterior part of the head are strongly striated. Posteriorly the stems of the uncini increase in length. On somite V all of the uncini have the form shown in fig. 37. The stem is straighter, beak less hooked and the teeth of the crest fewer and more erect. The guard is rudimentary.

The head and succeeding three or four segments are very smooth, iridescent and of a uniform deep purple or reddish-brown color above, not at all spotted or blotched; the next three segments are smooth and yellowish throughout; those of the middle region have pale anterior glandular zones, the remaining parts being yellowish and roughened; while posterior segments are pale throughout and thin-walled, except in the position of the longitudinal muscles and glandular zones.

The tubes are stout, thick-walled, hard but fragile structures, composed of fine sand grains, sponge spicules and bits of rock cemented together firmly and lined by a thin mucoid layer. Several tubes are sometimes coherent side by side.

Fragments of this species occur in the collections from the Gulf of Georgia, Station 4,197, 31 to 90 fathoms, on a bottom of sticky green mud and fine sand, and Station 4,198, 157 to 230 fathoms, on a soft green mud bottom. The type locality is Station 4,227, in the vicinity of Naha Bay, Behm Canal, 62 to 65 fathoms, dark green mud and fine sand.

*Nicomache carinata* is easily distinguished from *N. personata* Johnson by the possession of two achæitous preanal segments, while the latter has but one. In this respect it resembles *N. lumbricales* Malmg.,

but differs from that species in color, the form of the uncini and spines and the greater number of marginal divisions of the pygidium.

*Lumbriclymene pacifica* sp. nov. Plate XII, figs. 40-42.

The type and largest complete specimen, which is unduly elongated through maceration of the middle region, is 103 mm. long and 2 mm. in diameter.

The head (composed of prostomium and peristomium) is slightly compressed laterally and very short, the length only very slightly exceeding the depth. It totally lacks a cephalic plate and has a nearly straight dorsal profile, meeting the vertical and convex anterior profile at nearly a right angle. There is just the faintest indication of a palpode and of the anterior end of the median ridge. About midway on the side of the head a longitudinal furrow extends from the furrow  $\frac{I}{II}$  to a point just over the mouth, and just anterior to the ends of these furrows are the nuchal organs—a pair of small round depressions. A few faint short furrows run from near the end of the longitudinal furrow toward the mouth, and behind the latter the longitudinal furrow is cut by a transverse furrow which is very strongly developed on the dorsal side but fades out ventrally. From the posterior end of the peristomium a short re-entering half-ring is cut off ventrally by a rather distinct furrow which ends dorsally at the longitudinal furrow. The mouth is a rather conspicuous transverse slit situated about opposite the middle of the head and bounded both anteriorly and posteriorly by rather prominent lips, the former of which is marked by a short but deep longitudinal furrow.

Somite II is slightly shorter than the head. Behind it the segments increase regularly in length to IX at least, which is about three times as long as the head. Behind this several segments are probably still longer, but owing to their much softened state the exact length is uncertain. At the posterior end XVI is about as long as VI or VII and succeeding segments diminish rapidly, XIX and XX together only about equalling V in length. The two achæitous preanal segments are again much reduced.

Except that at the extreme posterior end a few are provided with prominent tori, all somites appear to be perfectly cylindrical. Somites II, III and IV bear setæ about the middle and just behind them is a faint furrow. The next five bear them near the anterior end just behind the glandular girdle. Posterior somites have their large swollen tori situated near their posterior ends and bearing the small tufts of setæ above and moderately long lines of crochets below. The two

preanal segments have two tubercles on each side, one above the other, in the position of the tori, but without setæ or uncini.

In the type the pygidium is very short—less than the two preanal segments—and is terminated squarely by a simple slightly convex plate of broadly elliptical outline. Another specimen has the pygidium more extended and nearly twice as long (on the dorsal side) as the two preceding segments, and the terminal plate is oblique at about 45°. In both specimens the plate is margined by a just evident fold, continuous except on the median ventral region. Just anterior to this margin dorsally is the anus.

The color is well preserved at the anterior end in a sharply contrasted pattern of reddish brown and white. On the head the former color occurs as follows: over the entire frontal surface, a half-ring on the dorsum of the posterior end of the prostomium, and a broad ring which occupies most of the peristomium and which is much more deeply colored dorsal to the longitudinal furrow than below it. The white areas are a broad band occupying the sides and dorsum of the prostomium above the mouth, and a very narrow ring on the anterior end of the peristomium. On several succeeding segments the arrangement is in a narrow anterior red ring, then a white ring occupying most of the glandular zone, and succeeding this an extensive red area occupying all of the rest of the segment. These colors are best developed on the dorsum, and gradually fade until by about somite VII only a nearly uniform dull yellow prevails. The glandular areas are, however, always whiter and more opaque than the remainder of the segment.

The peristomium and two preanal somites are achæitous, II to V bear small tufts of dorsal capillary bristles, and immediately below them two stout straight spines. Remaining somites have dorsal setæ tufts, and below them ventral series of crochets occupying from one-eighth to one-sixth of the circumference of the segment.

The anterior spines (fig. 40) are deep yellow, with opaque fibrous centres and straight blunt ends. In each tuft the setæ number from fourteen to twenty in two ranks. On the proximal part of the exposed portion is a rather wide wing, obliquely striated and often frayed and fringed on the free margin. Just below this the shaft is usually constricted, and beyond it tapers to a capillary tip which is short on the anterior and very long and delicate on the posterior segments, but always, so far as determined, quite devoid of hairs or awns.

Crochets are always few in number, never more than nine to fourteen occurring in each torus. They (fig. 41) are similar on all segments and

have well-differentiated shoulder, neck and head. The latter (fig. 42) bears a stout, strongly hooked beak, above which are four stout profile teeth of diminishing size, flanked by a few small lateral teeth. The guard arises well below the beak and consists of about twelve coarse fibres which spread in front of and above the apex of the latter. The internal fibrous structure is strongly developed.

Several tubes of this species occur in the collection and are interesting in structure. They measure 70 to 80 mm. long and 2.5 mm. in diameter, and occur either singly or attached in groups or to foreign bodies. Their walls are thin but hard and very brittle and are composed chiefly of small sand grains and sponge spicules, the latter of which are so attached that their pointed ends project freely toward the mouth of the tube. Various kinds of foraminifera and other foreign bodies are attached to the tubes, which are always dark-colored at the distal end and clean and pale elsewhere.

Two complete worms and a fragment together with four or five tubes were taken at Station 4,264, off Freshwater Bay, Chatham Strait, 282 to 293 fathoms, bottom of green mud.

*Sabellaria cementarium* sp. nov. Plate XII, figs. 45-51.

The fine species which represents the genus *Sabellaria* along the Pacific coast from Washington to Alaska is represented by a number of specimens, but unfortunately only one of these is complete, the others having lost the posterior end either through an attempt to remove the living worm from their tubes or by maceration in the tubes.

The type and only perfect specimen is 81 mm. long, of which the very slender fecal tube contributes 28 mm. The operculum has a diameter of 4.5 mm., the thorax a width of 6 mm., from which thickness the abdomen tapers regularly to about 2 mm. at the posterior end and then suddenly contracts to the 1 to 1.5 mm. of the fecal tube.

Counting the peristomium there are five thoracic segments exhibiting three distinct types of setation, then follow forty ordinary abdominal segments and about forty-six segments in the reduced fecal tube; finally the pygidium is a tubular structure 1.5 mm. long and .6 mm. in diameter with its posterior end serrate with about twenty minute teeth.

The prostomium is minute and completely concealed beneath the enormously developed peristomium. The small slit-like mouth is enclosed between a pair of closely appressed longitudinal folds, bounded laterally and somewhat enfolded ventrally by the enlarged palps, which are completely connate with the peristomium.

The peristomium is greatly enlarged and in the type measures 6.5



mm. long and 4.5 mm. wide. Dorsally it is completely closed, over-arching and concealing the prostomium and mouth. Together with the palpi which it bears below it forms a broad flat plate, of which the palps form the margins and are rolled inward and nearly touch ventrally. At its distal end the peristomium bears the operculum—a circular or somewhat elliptical disk directed slightly dorsad and composed of three whorls of stout, stiff, hard spines or peristomial setæ, so fitted together that they form a flexible and at the same time close-fitting and impenetrable plug to the tube. There are some indications in one specimen that this region may be regenerated when lost. The paleoli of the three rows differ in form and number as indicated below. Just external to and below the operculum is a circle of rather prominent conical opercular papillæ, which probably represent the much subdivided dorsal cirri of the peristomium. They are clearly divided in two symmetrical halves like the opercular paleoli, and number 16 to 20 on each side.

The palps may be opened from the ventral side and spread, together with the peristomium, as a flattened plate deeply pigmented below and bearing the branchial folds on the lateral thirds. Anteriorly the two palps are conjoined in the operculum, the branchiæ also meeting in the middle line below and behind the operculum. From 12 to 18 of these branchial folds or ridges occur on each side, the usual number in full-grown specimens being 18 pairs. They are prominent ridges running transversely across the free ventral margin of the palps and diminishing in size from behind forward. Owing to the medial bending of the anterior end of the palps, the anterior six pairs of branchiæ are arranged in the form of an arch and several of them lie in a nearly antero-posterior plane. Each gill consists of a stiff plate or ridge, with a serrate free margin behind which the filaments are borne. Except the very last, which usually bears but 10 filaments, the posterior gill ridges have about 20, the number decreasing regularly to the most anterior. All gill filaments are very slender and thread-like and the longest posterior ones equal the width of the peristomium.

At the base of the branchial region is a pair of short rounded lobes having much the aspect of the branchial plates, but shorter and thicker than they and coming in contact across the mouth slit. Continuing from this dorsally is a sloping ridge bearing a pointed conical cirrus longer than the rounded lobe, and above this again a small tubercle carrying a fan-shaped tuft of slender setæ.

Somite II is a short, simple ring partly fused with I and III ventrally to form the first ventral gland plate. Laterally it bears three conical

cirri, the ventral about as long as the segment, the middle about two-thirds as long, and the dorsal more than twice as long, slender distally and resembling the branchiæ, with which it stands as the first of a series.

The remaining three thoracic segments are a little longer and IV and V bear distinct ventral glandular plates. Their neuropodial setæ are stouter than those on I and II, but have no associated cirri and arise from the anterior margin of the segment on a level about midway between the neuropodial tufts of I and II. Each of these segments bears a dorsal cirrus or gill similar to that on II and in line with it, leaving a broad, naked area on the dorsum. Unlike II these somites bear no middle cirrus, but in place of it a prominent vertically elongated notopodial tubercle bearing a vertical series of large, coarse, paddle-shaped setæ.

Abdominal segments are somewhat flattened and only obscurely separated. As indicated above they decrease gradually in both length and diameter to the caudal appendage. Dorsally they present a somewhat arched area between the rows of gills and ventrally are excavated by a deep groove for the fecal tube, which is held in place by the tufts of slender neuropodial setæ crossing from side to side beneath it.

The body walls are exceedingly thin and delicate in the dorsal median area and permit the intestine to show through distinctly; the sides and ventral parts are decidedly thicker and more muscular. The abdominal gills have the same general form and position as the thoracic but are more perfect in structure, having larger blood-vessels, thinner walls and more numerous and prominent transverse ciliated ridges along their medial aspect. The first five or six are also much longer and have a length equal to the width of the interbranchial area. From this point they decrease in size very gradually and are totally absent from the last five or six segments.

On the first abdominal segment the parapodia are very extensively developed and the notopodial uncinigerous tori occupy the entire side of the segment from the branchia nearly to the ventral median line. Ventrally they become higher and terminate in a small free lobe, from beneath which arises a delicate ventral cirrus, and below this again the small neuropodial tubercle with its tuft of setæ. The tori decrease in length chiefly from the dorsal end, at first very slowly, then rapidly and at the same time become more sharply defined as distinct, thin, outstanding lobes bearing the uncini on their margins. Toward the posterior end they become merely small prominent pro-

cesses with somewhat constricted stalks standing midway between the branchiæ and the neuropodial setæ tuft. After the first abdominal segment the neuropodial cirrus quickly becomes reduced and in four or five segments has become quite rudimentary or totally absent.

The caudal or fecal tube has already been partly described. It is very delicate and thin-walled and bears no trace whatever of parapodia. Along its ventral side, however, what appear to be nerve ganglia can be distinctly seen and counted through the body wall, and delicate lines running in pairs from their neighborhood dorsad and cephalad have the same metameric arrangement.

The type specimen is richly colored. The outer whorl of paleoli are a warm golden, the inner a golden brown. The thoracic region is a rich sienna brown, especially deep on the dorsal interbranchial region of the peristomium as well as of succeeding segments, and on the sides of the latter and the first ventral plate. The ventral post-branchial lobe of I and the dorsal branchiæ are also well colored, but other cirri are pale. The gill filaments are pale purple, each with a deep brown basal spot. This specimen is a male, and the abdomen is colored pale cream from the contained sperm. Except for delicate lines formed of minute dots of reddish brown, which begin at the ventral setæ tufts and then pass dorsad along the anterior margin of the segment and in most cases continue on to the antero-lateral margin of the gill, there is no pigment in this region. The intestine is filled with a greenish-gray matter that colors the fecal tube. Most of the other specimens are paler, but one has the anterior brown parts of a deep chocolate. The genital products escape by means of a pair of openings through the body walls behind the parapodia of each segment and in several cases from large masses within the tubes.

The opercular paleoli vary from bright yellow to the more usual deep golden brown. They are all very stout, hard and rigid, and of peculiar irregular forms difficult of accurate description. All have slender, elongated stems, smooth superficially but striated longitudinally at the core, bearing very heavy and strong external blades, the great part of whose surface is roughened by numerous fine wavy parallel ridges which are slightly imbricated with their edges directed outward. The markings are not shown in the figures.

The outer whorl of normal opercula contains from 39 to 64, according to the size of the worm, between 50 and 60 being the most usual number. They are arranged in two symmetrical groups, though there appears to be a decided tendency for the right half to include one or two more than the left. Exclusive of the stem they (fig. 45o) consist

of a massive irregularly twisted base, from which arises a tongue-like piece the end of which is strongly flattened at right angles to the greatest thickness of the base and terminates in a fringed tip, from the central cleft of which arises a slender, densely hairy process (fig. 46). These paleoli are so arranged that they present a spreading rim, in which their twisted form causes the basal portions to be somewhat imbricated from below dorsalwards.

The middle paleoli number from 14 to 25, usually about 20, in symmetrical halves. They (fig. 45*m*) also have a thickened base, from which arises a very prominent upright spine, gracefully curved and tapered to an acute tip. The inner circle of paleoli contains from 14 to 22, but in nearly all cases they equal and alternate with those of the middle row. They (fig. 45*i*) have abruptly widened cleaver-shaped ends bearing a knife-like edge and strengthened on the opposite side by a thickened rim which ends in a short triangular beak. They are disposed somewhat obliquely to the middle line and converge ventrally.

Somite II bears a small tuft of strongly doubly-fringed, feather-like neuropodial setæ (figs. 49 and 50). On III the neuropodial setæ are partly of a short, more brush-like form and partly very small and of a slender, slightly fringed form. On the remaining thoracic segments they all become more sparsely fringed. The notopodials (fig. 47) on III, IV and V form a single vertical series of stout setæ, shaped like an Indian paddle with the end much split and frayed. At the base of each of these is a minute spatulate hairy setæ, with the end entire and somewhat produced in the middle, and the blade bent flatways.

Abdominal setæ are all very long and slender, but owing to different states of development appear of unequal length. Their shafts (fig. 48) are provided with numerous whorls of hairs united at the base into collars and much produced on one side.

The uncini (fig. 51) are very numerous and vary from 100 to 200 or even more on a torus. They are nearly colorless, delicate and inconspicuous, and consist of narrow elongated bodies provided with from 7 to 9 (seldom the former) very acute, appressed, overlapping teeth which are arranged in one series and diminish in size toward both ends. Each bears a stiff and rather brittle tendon at each end, the upper one being short and expanded distally into a small plate, while the lower bifurcates immediately into a shorter, irregularly thickened, more ventral branch and a slender uniform branch greatly elongated to many times the length of the uncini.

This species is probably rather common and occurs in the collections from the following stations: 4,220 (type), Admiralty Inlet, near Port

Townsend, Washington, 16-31 fathoms, green mud, sand and broken shells; 4,247, Prince of Wales Island, 89-114 fathoms, green mud with sand and broken shells; 4,274 (cotypes), Kadiak Island, 35-41 fathoms, green mud and fine sand.

*Samytha bioculata* sp. nov. Plate XII, figs. 52, 53.

The anterior prostomial lobe is quadrate, broader than long, its anterior border wider than the posterior, slightly concave and its lateral angles somewhat produced. Immediately behind and separated from it by a distinct transverse furrow is a second small quadrate lobe, with a rather prominent eye or close aggregation of several pigment specks at each antero-lateral angle. Behind this lobe the peristomium forms a broad, smooth, slightly convex area reaching to the branchiæ. Ventrally there is a very broad truncate under lip with a glandular margin. In the two known specimens only four to six very short clavate tentacles exist on each side.

The considerably enlarged peristomium projects ventrally as a broad lobe enveloping the lower lip and is marked by a narrow transverse line of gland cells. Elsewhere it is a simple smooth convex ring. The second somite is about two-thirds as long and marked by a broader glandular half-ring. The third (first setigerous) somite is very short, but succeeding ones increase in length rapidly and by about VIII equal the peristomium. All of the thoracic segments, of which there are nineteen, the last seventeen of which are setigerous, are somewhat muscularly thickened on the ventral half and provided with a narrow presetal half-girdle of glands. The entire dorsum between the setæ tufts is thin-walled and smooth throughout.

Fourteen segments in the type and larger specimen, and thirteen in the smaller cotype, form the abdomen. In the former this region comprises about one-third of the entire length; in the cotype not more than one-fourth. Owing to the projection of the parapodia from the angles this region is decidedly quadrate, but somewhat arched dorsally and marked ventrally by a narrow neural groove. The somites diminish regularly in all dimensions from before backward and the entire region tapers to the pygidium, which forms a ring surrounding the large anus and bears a pair of slender, prominently projecting cirri about equal to half the diameter of the body at the posterior end.

The four pairs of branchiæ are so much crowded antero-posteriorly that they appear to form a single series extending quite across the dorsal area of II and III. Closer study shows that two are anterior and slightly more lateral and two posterior and more median. They are all similar, slightly flattened, slender and elongated, their length

being about three times the diameter of the region of the body from which they spring.

Setæ begin on III as a pair of minute tufts arising from an elevated position just beneath the gills. The tufts on IV are also small and placed nearly as high. On succeeding somites the setæ become larger and more numerous and the tufts gradually assume a low station on the sides of the body as the abdomen is approached. They continue to XIX.

Uncinial tori begin on VI, or the fourth setigerous somite. Throughout the thoracic region they are low, but freely projecting, compressed folds which arise immediately ventral and slightly posterior to the setæ tufts and end ventrally in a freely hanging lobe or process. On abdominal segments the notopodia are distinctly separated from the neuropodia and project as small papillæ from the dorsal angles of the body. The neuropodia are small, compressed lappets constricted at the base and bearing the uncini along the free margin; apparently they lack cirri.

Setæ are all of one kind, slender, tapered and narrowly winged on both sides of the free portion nearly to the very acute tip. The uncini form a close single rank in which they are quite numerous (108 on X). From dorsal to ventral end of each series they decrease in length. They (fig. 52) are roughly triangular with a nearly square but sometimes projecting upper ligament process, above which the tooth-bearing margin rises but slightly. The inferior process varies in form, but is usually more or less incurved. Those of the type specimen almost constantly bear four long, slender, acute, overlapping teeth, the ventralmost of which is the stoutest, the two middle the longest and the upper the most slender. On the cotype a fifth smaller and sometimes minute tooth exists at the upper end of nearly all uncini (fig. 52a). Abdominal uncini (fig. 53) have the same form, but are much fewer in number.

This species is founded on two much macerated specimens, of which the larger and type is 30 mm. long and filled with large ova. The smaller example is 16 mm. long.

A nearly complete tube is 65 mm. long. Its basal third is soft, thin-walled and membranous. Beyond this the walls gradually thicken by the accumulation of silty material until they attain a diameter of about 5 mm. This entire region of the tube is supported and protected by siliceous sponge spicules, the ends of which project in all directions and produce a very firm and bristling structure.

Both specimens come from Station 4,197, Gulf of Georgia, 31 to 90 fathoms, sticky green mud and fine sand.

*Amphiteles scaphobranchiata* sp. nov. Plate XII, figs. 54-61.

A single well-preserved specimen represents this noteworthy species. The length without branchiæ is 32 mm., the branchiæ 7 mm., and the maximum width in the anterior part of the thorax 2.8 mm.

The anterior lobe of the prostomium (fig. 54) is almost completely divided by a longitudinal furrow into a pair of somewhat slender tentacle-like divisions which are somewhat divergent anteriorly. A narrow transverse welt passes across the base of this region and is partly concealed by the much larger and more prominent sensory folds which lie behind it. These pass from the lateral borders of the head nearly transversely to the middle line, where they meet in a wide angle. Laterally they are continuous with the lateral lobes or folds which join the frontal lobe beneath. The tentacular membrane lies below the frontal and lateral lobes and is partly embraced by the peristomium. It bears from twelve to fifteen tentacles on each side, the lateral ones being very short and the middle ones as much as two-thirds the width of the thorax. All and especially the shorter ones are more or less clavate.

The prostomium passes without any clear demarkation into the peristomium, which reaches as a smooth unbroken convex surface to the branchial segment. Dorsally it is remarkable for its extent, smoothness and absence of furrows. Its length and breadth are each equal to about two-thirds of the width of the branchial segment. In the middle line it reaches to the interbranchial shield, but its posterolateral angles are cut off by the paleolar tubercles and lateral portions of somite II. Ventrally the peristomium forms a large, broadly truncated lower lip, slightly inserted into II and embraced laterally by the paleolar tubercles.

The second somite is more than half as long ventrally as the peristomium, but except for the narrow strip extending dorsally beneath the branchiæ it ends abruptly at the enlarged paleolar tubercles. Somite III is very short and IV slightly longer, the two combined just equalling the length of II. Behind this region the segments again diminish in both length and diameter to the pygidium. With the exception of the last three or four, the thoracic segments are ill defined on the ventral and not at all on the dorsal side. Up to the level of the setæ tufts, where a lateral shelf-like ridge is formed, the body walls are rather thick and firm, with slight anterior glandular bands and obscure ventral plates. Dorsal to the setæ the body for the entire length is

perfectly smooth and unsegmented. The last three or four thoracic segments are transitional in character to the abdominal. The latter are more distinctly differentiated, owing in part to their more prominent parapodia and in part to the greater depth of the ventral furrows. The last few segments are separated by obvious furrows even on the dorsal side. Owing to its being crushed the pygidium cannot be described further than to refer to the pair of prominent, slender and stiff cirri which it bears. A distinct neural groove extends throughout the abdominal region and even on to several of the posterior thoracic segments. A remarkable smoothness and peculiar dull iridescence characterizes the entire cuticle of this worm.

If normally formed in this specimen the branchiæ are highly characteristic. All four pairs are large and stout and arise in the usual manner, two pairs anterior and more lateral from II and III and two more posterior and median from IV, those of each side being completely coalesced at the base. A small shield-shaped area separates them in the middle line, but otherwise they cover the entire width of the dorsum. Viewed from above they cover and conceal the entire head and curve downward in front of the prostomium and beneath the tentacles. All are very broad and flat at the base, especially the two inner ones on each side. In the case of three of them the outer one-third is less flattened and tapers to a blunt point. The anterior median of both sides, however, expands into a broad flat plate (fig. 56) somewhat lobed on the margins and terminated by a tapering process bent sharply on itself into a hook. This process is complete on one side only, having been broken off of the other. Probably all of the branchiæ are straight in life, but they are peculiarly stiff and rigid and their cuticular covering is thick and marked by fine transverse striæ, but otherwise smooth.

Thoracic parapodia consist of simple setigerous tubercles arising from the lateral muscular shelf and short auriculate tori with both dorsal and ventral angles produced somewhat freely. Abdominal parapodia (fig. 57) consist of prominently projecting hatchet-shaped ventral tori, each bearing a minute cirriform process, and sharply bent, clavate dorsal cirri which replace the setigerous tubercles of the thoracic region. Parapodia of successive somites are united by a beaded muscular ridge which passes along the side of the abdomen between the torus and cirrus. The worm consists of thirty-two segments, of which II bears the paleoli, III to XIX ordinary setæ, and VI to XXXII uncini.

The paleoli (fig. 58) are of a clear, bright glistening straw color and



are arranged in a half tubular figure at the base, from which they diverge and spread distally in a fan-shaped fascicle. In each tuft the shortest one (at the inner end of the posterior limb) is about twice as stout as the longest. Distally they all taper regularly and rather rapidly to very long, slender, acute and stiff tips. Except for these tips they are striated conspicuously in both the longitudinal and transverse direction.

The ordinary setæ (fig. 59) are few in number and form rather small close tufts. They are apparently similar on all segments, being rather slender with tapering stems and acute, tapering tips, striated somewhat obliquely, and provided on one side with a wing of moderate width marked with distinct oblique striæ.

The uncini are numerous on the thoracic segments (135 on X). They have the form shown in figs. 60 and 60a, being roughly triangular, with large bases, a prominent superior ligament process, a projecting rounded lower angle and long tooth-bearing border with five or six strong acute teeth, the lowermost of which is peculiarly bevelled and covers a short inferior ligament process which nearly touches its lower surface. Abdominal uncini (fig. 61) are fewer in number (78 on XXV), much smaller, and formed quite differently. They have small bases and high outstanding tooth-bearing rami, and apparently lack the inferior ligament process.

Several thick-walled mud tubes in the same bottle were probably fashioned by this species.

Type locality, Queen Charlotte Sound, off Fort Rupert, Vancouver Island, B. C., Station 4,201, 138 to 145 fathoms, soft green mud, sand and broken shells.

*Chone gracilis* sp. nov. Plate XII, figs. 62-66.

A very pretty small species resembling *Chone duneri* Malmgren in proportions, but differing from that species in the short, and broadly winged, barbless tips of the branchiæ. From *C. teres* Bush this species is easily distinguished by its much longer branchiæ, small number of abdominal segments and the more elongated form of the abdominal uncini.

The type specimen has a total length of 32 mm., of which the branchiæ make 12 mm. and the thorax 5 mm., the diameter for nearly the entire length being about 2 mm.

The branchial bases are simple and very low, being completely concealed by the high collar. Ten pairs of delicate branchiæ extend equally to a length of more than one-half of the body. The stems are united by a very delicate membrane for three-fifths of their length and

the remainder is broadly winged on both sides. The barbs are very delicate and are absent from an acute foliaceous tip about 2 mm. long. Eyes are totally wanting.

A collar of the form typical of the genus rises to a height of two and one-half times the length of the segment which follows it. The dorsal ends are refolded into the dorsal sinus and a slight notch occurs in a median ventral position; otherwise it is quite simple. The very small tentacles are shorter than the diameter of the body.

Nine segments, 8 of which are setigerous, form the thorax and 51 segments the abdomen. For nearly its entire length the body is cylindrical and of almost uniform diameter, but in the posterior fourth becomes somewhat broader and depressed before tapering rapidly to the caudal end. No distinct glandular ventral plates are developed, but all of the thoracic and the anterior three or four abdominal segments are completely encircled by a thick glandular layer. The thoracic and a few anterior abdominal segments are strongly biannulate, the middle abdominal are simple and half as long as wide, while the posterior are much shorter and more crowded. The fecal groove is distinct on the caudal fourth of the abdomen, and conspicuous on a few anterior abdominal segments, also where it passes obliquely around the right side of the first abdominal segment and on the dorsum of the thorax; elsewhere it is faint or absent. A few small ova are present in the coelom. Every portion of this worm is white, without a trace of pigment anywhere.

All setæ tufts are short but rather prominent; uncinigerous tori are also short and nearly uniform, diminishing only slowly and regularly from the first to the last. The setæ and uncini are all delicate and colorless. The collar fascicle consists of a small number of narrowly winged, acute, capillary setæ. Remaining thoracic somites have a larger number of partly capillary, partly spatulate setæ placed between two small lappet-like processes. The former consist of a dorsal row of acute tapering setæ with one moderately wide and one just perceptible wing and a small number of very small and inconspicuous crooked setæ (fig. 62) with rudimentary wings found below the spatulated setæ. The spatulate setæ (fig. 64) are arranged in two rows of about ten each; they have delicate, striated, usually symmetrical, obovate blades, and long very slender mucronate processes. The abdominal setæ (fig. 63) are also in one series, few in number, rather coarser than the thoracic and with the two wings narrow and about equally developed. Thoracic uncini contain a single series of erect crochets or hooked setæ (fig. 65) with striated stems and the slightly enlarged head thrown back, a large coarsely divided crest and stout,

blunt beak. On somite V there are 13 in a torus, on somite VIII 11. The abdominal tori contain uncini of the form shown in fig. 66, with quadrate bases and heads of much the form of the thoracic crochets but strongly recurved on the base. They are more numerous than the thoracic crochets, somite XXI containing 17.

The tube is nearly transparent, little tortuous and almost free from sand.

The single specimen comes from Station 4,274, Alitak Bay, Kadiak Island, 35 to 41 fathoms, on a bottom of green mud and fine sand. A smaller specimen was taken at Station 4,253, Stephens Passage, 131 to 188 fathoms, rocks and broken shells.

#### EXPLANATION OF PLATES X, XI AND XII.

##### PLATE X.—*Notophyllum imbricatum*—figs. 1-3.

Fig. 1.—Dorsal view of head of type.  $\times 13$ .

Fig. 2.—Outline of parapodium of middle region, seen from in front.  $\times 13$ .

Fig. 3.—Distal end of a neuropodial seta of average length.  $\times 600$ .

##### *Eulalia quadrioculata*—figs. 4-6.

Fig. 4.—Dorsal view of anterior end of type.  $\times 24$ .

Fig. 5.—Posterior view of parapodium from somite XXV.  $\times 32$ .

Fig. 6.—End of an average seta from somite X.  $\times 600$ .

##### *Eulalia longicornuta*—figs. 7 and 8.

Fig. 7.—Posterior view of parapodium from somite XXV of type.  $\times 32$ .

Fig. 8.—End of a seta from somite X.  $\times 600$ . Some of the setæ have even longer appendages.

##### *Pionosyllis magnifica*—figs. 9-11.

Fig. 9.—Dorsal view of anterior end of type.  $\times 32$ .

Fig. 10.—Anterior view of parapodium of somite XXV.  $\times 32$ .

Fig. 11.—End of a seta from the middle of a fascicle on XXV.  $\times 600$ .

##### *Stauronereis annulatus*—figs. 12 and 13.

Fig. 12.—Anterior end of cotype from above.  $\times 82$ .

Fig. 13.—A parapodium from somite XXV, anterior view.  $\times 82$ .

##### *Brada pilosa*—figs. 14-17.

Fig. 14.—A medium-sized extended papilla from the dorsum of the middle region, showing ring of adhering silt.  $\times 113$ .

Fig. 15.—An extended papilla from the ventral surface.  $\times 113$ .

Fig. 16.—A portion of the middle of a notopodial seta from XV.  $\times 250$ .

Fig. 17.—Exposed portion of neuropodial seta from XV.  $\times 98$ . a, portion of middle of the same.  $\times 250$ .

##### PLATE XI.—*Stauronereis annulatus*—figs. 18-22.

Fig. 18.—Distal portion of jaw from below.  $\times 130$ .

Fig. 19.—Forked seta from middle of notopodial fascicle of somite XXV; a, another of the same slightly rotated and foreshortened.  $\times 800$ .

Fig. 20.—Portion of the middle of a capillary neuropodial seta from somite XXV.  $\times 800$ .

Fig. 21.—A short-bladed compound neuropodial seta from the middle of the fascicle of XXV.  $\times 800$ .

Fig. 22.—A long-bladed compound seta from the same somite.  $\times 800$ .

##### *Travisa pupa*—fig. 23.

Fig. 23.—A small portion from near the distal end of a notopodial seta from the middle region.  $\times 800$ .

##### *Notomastus giganteus*—figs. 24 and 25.

Fig. 24.—An entire crochet from the middle of the body.  $\times 333$ .

Fig. 25.—Profile view, and a face view, of the end of one of the same.  $\times 800$ .

*Maldane similis*—figs. 26–30.

Fig. 26.—Slightly winged seta from II.  $\times 333$ .

Fig. 27.—Hispid capillary seta from somite XV.  $\times 480$ .

Fig. 28.—End of crochet from somite III.  $\times 480$ .

Fig. 29.—Entire crochet from X.  $\times 110$ .

Fig. 30.—Distal end of the same.  $\times 480$ .

*Maldanella robusta*—figs. 31 and 32.

Fig. 31.—Two entire crochets from somite XV.  $\times 110$ .

Fig. 32.—The end of one of the same.  $\times 480$ .

*Clymenella tentaculata*—figs. 33–35.

Fig. 33.—Middle crochet from somite II, entire.  $\times 110$ .

Fig. 34.—End of the same.  $\times 480$ .

Fig. 35.—End of a middle crochet from V.  $\times 480$ .

*Nicomache coronata*—figs. 36–39.

Fig. 36.—Small portion of a fiber seta from somite X.  $\times 800$ .

Fig. 37.—End of a crochet from somite V.  $\times 480$ .

Fig. 38.—An entire crochet from somite XV.  $\times 110$ .

Fig. 39.—End of the same.  $\times 480$ .

PLATE XII.—*Lumbrichymene pacifica*—figs. 40–42.

Fig. 40.—End of a spine from II.  $\times 98$ .

Fig. 41.—An entire crochet from somite X.  $\times 83$ .

Fig. 42.—End of the same.  $\times 440$ .

*Nicomache coronata*—figs. 43 and 44.

Fig. 43.—Small seta from somite X.  $\times 360$ ; a, small portion of the same.  $\times 600$ .

Fig. 44.—Large seta from somite X.  $\times 360$ .

*Sabellaria cementarium*—figs. 45–51.

Fig. 45.—Three spines forming a middle segment of the operculum, shown in profile in as nearly as possible their natural relations; i inner, m middle, and o outer spines.  $\times 32$ .

Fig. 46.—A face view of the end of an outer spine.  $\times 32$ .

Fig. 47.—Middle notopodial seta from somite III.  $\times 32$ .

Fig. 48.—Portion of an ensheathed capillary notopodial seta from somite XX.  $\times 440$ .

Fig. 49.—Bipinniform neuropodial seta from II.  $\times 98$ .

Fig. 50.—A portion of the middle of the same.  $\times 440$ .

Fig. 51.—Middle abdominal uncinus.  $\times 440$ .

*Samytha bioculata*—figs. 52 and 53.

Fig. 52.—Uncinus from somite X of type.  $\times 600$ ; 52, the same from somite X of the cotype, somewhat foreshortened.  $\times 600$ .

Fig. 53.—Uncinus from somite XXV.  $\times 600$ .

*Amphicleis scaphobranchiata*—figs. 54–61.

Fig. 54.—Dorsal aspect of anterior end of type, with branchiæ cut away and separated to show the prostomium.  $\times 9$ .

Fig. 55.—Ventral aspect of the same with the branchiæ in place.  $\times 9$ .

Fig. 56.—Distal portion of one of the anterior middle branchiæ.  $\times 9$ .

Fig. 57.—One of the abdominal parapodia.  $\times 24$ .

Fig. 58.—A paleolus from the middle of the fasciculus.  $\times 83$ .

Fig. 59.—A seta from somite X.  $\times 250$ .

Fig. 60.—Two forms of uncini from somite XII, the five-toothed one i somewhat foreshortened.  $\times 600$ .

Fig. 61.—An uncinus from XXV.  $\times 600$ .

*Chone gracilis*—figs. 62–66.

Fig. 62.—A small bent seta from somite V.  $\times 360$ .

Fig. 63.—A winged seta from XXI.  $\times 250$ .

Fig. 64.—A spatulate and mucronate seta from VI.  $\times 360$ .

Fig. 65.—A crochet from VI.  $\times 360$ .

Fig. 66.—An uncinus from XXI.  $\times 360$ .

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June 1, 1906.

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PROCEEDINGS  
OF THE  
Academy of Natural Sciences  
OF  
PHILADELPHIA

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VOLUME LVIII  
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1906

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THE ACADEMY OF NATURAL SCIENCES  
OF  
PHILADELPHIA  
1906

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## MAY 1.

MR. ARTHUR ERWIN BROWN, Vice-President, in the Chair.

Forty-six persons present.

The Publication Committee reported that a paper entitled "Additional New Species of Polychæta from the North Pacific," by J. Percy Moore, had been offered for publication (April 19, 1906).

The deaths of Clarence H. Clark, a member, March 13, and of Lionel S. Beale, a correspondent, March 28, were announced.

DR. BENJAMIN SHARP made a communication on pearls and pearl fisheries. (No abstract.)

---

MAY 15.

The President, SAMUEL G. DIXON, M.D., in the Chair.

Thirty-four persons present.

The Publication Committee reported that a paper entitled "Records and Descriptions of Non-Saltatorial Orthoptera from British Guiana," by James A. G. Rehn, had been offered for publication (May 7, 1906).

The death of Carl V. Vischer, M.D., a member, May 14, was announced.

HENRY LEFFMAN, M.D., made a communication on the newer views regarding the nature of matter and their bearings on biology. (No abstract.)

Mr. Walter F. Herzberg was elected a member.

The following were ordered to be printed:

RECORDS AND DESCRIPTIONS OF NON-SALTATORIAL ORTHOPTERA FROM  
BRITISH GUIANA.

BY JAMES A. G. REHN.

The records given in the following pages are all from a collection of Orthoptera made in 1901 at Demerara, British Guiana, by R. J. Crew, and for the privilege of studying which the author is indebted to Prof. Lawrence Bruner. The series contained sixty-one specimens, representing thirty-four species, of which six are new. The types are in Prof. Bruner's collection.

BLATTIDÆ.

ANAPLECTA Burmeister.

*Anaplecta pulchella* n. sp.

Type: ♀; Demerara, British Guiana, 1901. (R. J. Crew.)

Closely allied to *A. mexicana* Saussure and *dohrniana* Saussure and Zehntner, but differing from *mexicana* in the narrowly incised supra-anal plate, the more angulate proximal portion of the appendicular field of the wings, and in some details of the coloration. From *dohrniana* it differs in the wings, in the coloration and somewhat in the shape, but agrees in the shape of the supra-anal plate.

Size rather large (for the genus); form rather flattened and sub-elliptical; surface glabrous. Head about completely hidden under the pronotum; interspace between the eyes almost twice the depth of one of the eyes; antennæ sparsely haired. Pronotum transversely ovate, the cephalic margin regularly arcuate, caudal margin very slightly arcuate, lateral margins rounded obtuse-angulate; disk somewhat deflected laterad. Tegmina exceeding the apex of the abdomen, sub-lanceolate with the costal margin slightly arcuate except proximad where it is rather strongly arcuate, sutural margin straight, apex acute; basal field small, sub-coriaceous; anal field elongate sub-pyriform in shape and containing four veins; costal veins thirteen in number, the interspaces between the distal ones supplied with short spurious veins which do not coalesce with the discoidal vein; median vein with four rami of which the second (enumerating proximo-distad) is bifurcate. Wings with the appendicular field of medium size, sub-rectangulate with the margins rounded and the proximal angle decidedly obtuse;

clavate costal veins seven in number, the clavation being very large and short, in fact decided inflations, non-clavate costals five in number, distad of the clavate ones; medio-discal area with quadrate interspaces; axillary vein with one principal branch diverging caudad, which latter has two rami. Supra-anal plate transverse, rounded with a slightly median emargination; subgenital plate not reaching to the apex of the supra-anal plate, inflated and with the caudal section compressed and narrowly divided, reminding one of the structure of the valves of the Blattinae. Femora with their ventral margins spined.

General color tawny above; head ochraceous with a pattern of four transverse and one short longitudinal occipital bars of seal brown, eyes seal brown, antennae ochre yellow proximad and dull brownish distad. Pronotum with the disk seal brown and the lateral portions hyaline, the disk broad caudad narrowing cephalad. Tegmina of the general color with a spot in the anal field, a more prominent one at the base of the discoidal field and another rounded one near the middle of the discoidal field raw umber. Wings very slightly washed with olive, except the sections adjacent to the proximal portion of the costal margin and the caudal section of the inserted angle of the appendicular field, which are washed with ochre yellow. Ventral surface and limbs pale clay color, margined, lined and touched with mummy brown.

*Measurements.*

Length of body, . . . . .	7.6 mm.
Length of pronotum, . . . . .	2.2 "
Greatest width of pronotum, . . . . .	3 "
Length of tegmen, . . . . .	8 "
Greatest width of tegmen, . . . . .	2.5 "

The type is the only specimen seen.

***Anaplecta fulgida* Sauseure.**

Two males, two females.

Two of the above specimens belong to the form of the species with the disk of the pronotum dark, both sexes being represented. The tegmina in these dark specimens are somewhat darker than in the other individuals.

This species has been recorded from Tabasco, Mexico, Guatemala and Piedras Negras, Costa Rica, this constituting the first South American record.

E.

**PSEUDOMOPS** Serville.

***Pseudomops ornicornis* (Burmeister).**

One male, one female.

While these specimens would, by their uniform black antennae, fall

under *luctuosa* (Saussure), the original description of *crinicornis* contains nothing at variance with the material examined, no mention being made of the antennæ, while the median whitish spots on the tegmina are distinctly specified. It would appear from the description that the form described as *crinicornis* by Saussure and Zehntner<sup>1</sup> is not the *crinicornis* of Burmeister. Whether *lectuosa* is distinct from *crinicornis* is a matter which cannot be settled here, the two having already been synonymized.

The specimens studied show that the male is more uniformly colored than the female, the pronotum being without a light caudal margin and the median tegminal spots are absent, while the pale border of the coxæ and ventral abdominal segments are much narrower than in the female.

**PSEUDOPHYLLODROMIA** Brunner.

***Pseudophyllodromia pavonacea* Rehn.**

1903. *Pseudophyllodromia pavonacea* Rehn, Trans. Amer. Ent. Soc., XXIX, p. 262. [Bartica, British Guiana.]

One male.

This specimen is inseparable from the type with which it has been compared.

***Pseudophyllodromia fasciatella* Saussure.**

Three males, one female.

These specimens agree perfectly with a series of sixteen individuals from Bartica, British Guiana.

***Pseudophyllodromia obscura* Saussure.**

1874. *Pseudophyllodromia obscura* Saussure, Mém. Soc. Phys. et d'Hist. Nat. Genève, XXIII, p. 98. [Brazil.]

Four females.

These specimens agree well with the description except that the disk of the pronotum is red-brown overlaid with blackish instead of maroon brown as described.

***Pseudophyllodromia prona* n. sp.**

Types: ♂ and ♀; Demerara, British Guiana. 1901. (R. J. Crew.)

Allied to *P. peruana* and *lineolata* Saussure, and differing from the former in the strongly lined interocular space, the color of the face and the coloration of the tegmina, the pale portions of the latter being small maculations and not whole areas. From *lineolata* it differs in the maculation of the pronotum, the general color of the head and the smaller tegminal markings. No other species of the genus appears to be any way as closely related as the two mentioned above.

---

<sup>1</sup> Biol. Cent.-Amer., Orth., I, p. 33.

Size medium; form as in other species of the genus but slightly broader. Head considerably exserted, the eyes rather prominent, the interspace between them not as wide as the depth of the eye in either sex; antennæ filiform, very sparsely haired, in length very considerably exceeding the length of the body. Pronotum transverse sub-elliptical, cephalic margin with an extremely slight median angulation; caudal margin distinctly but not greatly angulate, the margin laterad of the angulation slightly emarginate; lateral margins arcuate producing slightly lateral cephalic and caudal angles; surface of the disk with two impressed areas, one on each side, extending caudo-laterad from about the caudal fourth of the pronotum; lateral portion of the pronotum considerably depressed. Tegmina with the venation prominent; costal margin arcuate on the proximal half, about straight with a hardly perceptible emargination in the distal half, sutural margin with two arcuations, one of the anal field, the other of the remainder of the tegmen; apex narrowly rounded; basal field narrow, limited to about the proximal third; anal field elongate-obovate, the anal sulcus more impressed in the male than in the female; costal veins thirteen to sixteen in number, rami of the median vein all longitudinal. Supra-anal plate of the male shorter than the subgenital plate, cerci over twice the length of the subgenital plate, moniliform, tapering from the middle, subgenital plate rather short, transverse, the apex narrow and shallowly emarginate. Supra-anal plate of the female shorter than the subgenital plate, cerci similar to those of the male, subgenital plate flat, the apical margin with a deep, very narrow median incision. Femora spined.

General colors clove brown and pale ochre yellow. Head with three median, longitudinal, closely placed, parallel ochre yellow lines on the interocular space, the face with five transverse maculations of the same color, the dorsal one a complete fine line, the second, between the antennæ, a broadly V-shaped mark, the third a row of four sub-circular maculations, the fourth, on the clypeal suture, a thick, narrowed mesad line, the fifth a simple line across the clypeus; eyes walnut brown; antennæ strongly infuscate except a brief ferruginous proximal section. Pronotum with the disk clove brown, a narrow median line and the lateral section pale ochre yellow, a spot on the caudal section of the pale lateral sections clove brown; caudal margin narrowly pale. Tegmina with the base color deep brownish, the basal field and interspaces between the veins of the anal area and between the costal veins and two spots in the proximal section of the discoidal field, one in the very narrow proximal section and the other just distad of it, pale

ochre yellow. Limbs ochre yellow marked with clove brown, the caudal broadly lined dorsad, and the tibiae infusate distad.

*Measurements.*

	♂	♀
Length of body, . . . . .	9.2 mm.	10 mm.
Length of pronotum, . . . . .	3 "	3 "
Greatest width of pronotum, . . . . .	3.9 "	4 "
Length of tegmen, . . . . .	9.6 "	10.5 "
Greatest width of tegmen, . . . . .	3 "	3 "

The types are unique.

**ISCHNOPTERA** Burmeister.

*Ischnoptera nyctiboroides* n. sp.

Type: ♀; Demerara, British Guiana. 1901. (R. J. Crew.)

Belonging to the group containing *I. azteca*, *tolteca*, *nana* and *parvula*, but differing from all in the larger size, and apparently from most of them in the comparatively large intercalary area of the wings.

Size rather large; form robust, general form and coloration superficially reminding one of a *Nyctibora*; surface glabrous, but not with a very high-polish. Head not hidden by the pronotum, the occipital margin evenly arcuate, interspace between the eyes slightly wider than the depth of one of the eyes; mandibular palpi with the distal joint elongate-elliptical when viewed dorsad, the ventral surface excavate for the entire length. Pronotum of the shape usually found in *Ischnoptera*, the cephalic margin sub-truncate, the caudal margin sub-truncate with an extremely slight median angulation, lateral margins slightly arcuate, the greatest width caudad; lateral sections somewhat depressed, the disk without depressions. Tegmina extending beyond the tip of the abdomen by about two-thirds the length of the pronotum; costal margin evenly arcuate; sutural margin straight except in the distal fourth, where it is obliquely diverted toward the apex which is in the general curve of the costal margin and rounded acute-angulate in character; basal field not extensive; anal field elongate-obovate, the apex blunt; veins of the anal area seven in number, the costal veins very numerous, discoidal field with the veins distinctly longitudinal. Wing with the greatest width contained slightly more than one and one-half times in the length; costal veins about eleven in number excluding the branches of the mediastine vein, the majority being distinctly but not at all greatly thickened near the margin; discoidal vein with a caudal ramus diverging near the middle anterior ulnar vein with two complete and about two incomplete rami;

intercalary area rather small but distinct, extending about a sixth the way to the base of the wing, the apical margin of the area very gently obtuse-angulate. Supra-anal plate transverse, somewhat produced mesad and very narrowly emarginate; cerci about equal to the subgenital plate in length, tapering in the distal half; subgenital plate somewhat transverse, the distal margin arcuate, not emarginate and not distinctly excavated for the cercal bases. Cephalic femora armed on the ventro-cephalic margin, with about five large spines placed mesad and a number of slightly smaller ones distributed between the larger spines and the distal extremity; median and cephalic femora with the ventral margins armed.

General color vandyke brown, narrow lateral areas on the pronotum and the basal areas of the tegmina ochre yellow. Head uniform except for the antennæ, the regions of their insertion and the clypeus which are dull ochraceous. Pronotum with the median area very dark, almost seal brown, the lateral light areas being connected by a thread of the same color, which extends around the cephalic margin. Tegmina almost ochraceous-rufous when viewed by reflected light, the area of the right tegmen covered by the left being vandyke brown. Wings washed with vandyke brown, the anterior field with the suffusion very strong, the color being quite solid around the costal veins. Abdomen with the segments margined with seal brown, a broad bar of the same color paralleling the lateral margins and suffusing the subgenital of the preceding plate. Limbs ochraceous, the coxæ each with two transverse bars of seal brown connected along the lateral sulcus of the coxa by a longitudinal bar of the same color.

#### Measurements.

Length of body, . . . . .	17.6 mm.
Length of pronotum, . . . . .	4.3 "
Greatest width of pronotum, . . . . .	6 "
Length of tegmen, . . . . .	17 "
Greatest width of tegmen, . . . . .	5.2 "

The type is the only specimen seen by the author.

#### BLATTELLA Caudell.

##### *Blattella minor* (Brunner).

1865. *Phyllodromia*] *minor* Brunner, Nouv. Syst. Blatt., p. 94. [Brazil.]

One male.

This specimen fits Brunner's description of this species, except that the bars on the pronotum are fairly well separated, while Brunner says "linea separanti tenuissima."

*Blattella inexpectata* n. sp.

Type: ♀; Demerara, British Guiana. 1901. (R. J. Crew.)

In general appearance this form resembles *B. parana* (Walker) from Para, but it is larger with a richer coloration and with the caudal margin of the pronotum more arcuate. In some respects this species resembles the *vitrea-dilatata-pavida* group but is more slender, bearing a considerable superficial resemblance to *Ischnoptera blattoides*.

Size medium; form moderately depressed, elongate-elliptical; surface glabrous. Head almost entirely covered by the pronotum, narrowest portion of the interspace between the eyes slightly less than the depth of one of the eyes; antennæ well separated at the bases, in length extending caudad to the distal extremity of the caudal coxæ. Pronotum moderately transverse, ovate, narrow, cephalic margin subtruncate, caudal margin moderately arcuate with an extremely slight median angulation, lateral margins arcuate with the greatest width very slightly caudad of the middle; lateral sections moderately depressed. Tegmina slightly exceeding the apex of the abdomen, the greatest width contained slightly more than three times in the length; costal margin arcuate, the arcuation of the proximal third much greater than that of the remainder of the margin; sutural margin nearly straight, very obliquely truncate in the apical fourth where it turns to meet the narrowly rounded apex; basal field narrow and covering slightly more than a third of the length of the tegmen; anal field obovate in shape and about equalling the basal field in length; costal veins about fourteen in number, median vein with four rami, the distal of which has four branches, some of which has the branching carried two stages farther; anal area with five veins. Wings with the costal veins numbering about nine, the majority of the veins being distinctly incrassate distad; anterior ulnar vein bearing three complete rami. Supra-anal plate trigonal with a rather large median emargination; cerci about equal to the subgenital plate in length, fusiform; subgenital plate moderately inflated, somewhat tectate, apical margin shallowly emarginate, well marked cercal sinuations present. Cephalic femora armed on the ventro-cephalic margin with four large median and one large distal spine, the intervening area filled with fine comb-like spines. Median and caudal femora with the ventral margins spined.

General color ochraceous, becoming ochraceous-rufous on the disk of the pronotum and the section of the tegmina which when in repose cover the body. Eyes bistre; lateral sections of the pronotum and costal section of the tegmina translucent ochre yellow, the section of the left tegmen which in repose is covered by the right is very pale,



nearly buff in color. Wings strongly washed with ochraceous; limbs pale ochraceous.

*Measurements.*

Length of body, . . . . .	13 mm.
Length of pronotum, . . . . .	3.5 "
Greatest width of pronotum, . . . . .	4.2 "
Length of tegmen, . . . . .	11.3 "
Greatest width of tegmen, . . . . .	3.8 "

The type is unique.

**NYCTIBORA** Burmeister.

1838. *Nyctibora* Burmeister, Handb. d. Entom., II, Abth. II, pt. I, p. 501.

Included *N. crassicornis*, *sericea*, *holosericea* and *latipennis* Burm. Kirby has selected *sericea* as the type.

**Nyctibora tomentosa** (Serville)?

1839. *Blatta tomentosa* Serville, Orthoptères, p. 86. [Surinam.]

Two males.

These specimens show some few characters at variance with the original description, but agree with the description of a female given by Saussure.<sup>2</sup> Walker's *tenebrosa* from Demerara appears to be a rather different insect.

**PARATROPES** Serville.

**Paratropes subsericeus** Saussure.

1864. *Paratropes subsericeus* Saussure, Mém. l'Hist. Nat. Mex., 3me Mém., p. 63. [Surinam.]

One female.

This specimen is referred to *subsericeus* instead of *elegans* Burmeister, of which the former has been considered a synonym. The description of *elegans*, although very brief, does not fully fit the specimen in hand, while that of *subsericeus* fully describes the individual examined. The author does not assert that the two are distinct species, but Saussure's name represents the type examined and Burmeister's does not.

**EPILAMPRA** Burmeister.

**Epilampra abortivipennis** Rehn.

1903. *Epilampra abortivipenna* Rehn, Trans. Amer. Ent. Soc., XXIX, p. 273. [Bartica, British Guiana.]

One female.

The type of this species was erroneously described as a female, a re-examination showing it to be a male.

<sup>2</sup> *Miss. Scient. Mex., Orth.*, p. 69.

The female is larger and bulkier than the male, but is otherwise very similar. The supra-anal plate of the female is transverse, rounded and with a moderately deep V-shaped median emargination, the cerci are about equal to the supra-anal plate in length, subequal in the proximal half, tapering in the distal half, supra-anal plate large, moderately inflated, cercal sinuations slight, the apical margin arcuate.

*Measurements of Female.*

Length of body, . . . . .	26 mm.
Length of pronotum, . . . . .	6.5 "
Greatest width of pronotum, . . . . .	8.3 "
Length of tegmen, . . . . .	18.5 "
Greatest width of tegmen, . . . . .	6.5 "

*Epilampra lucifuga* Rehn.

1903. *Epilampra lucifuga* Rehn, Trans. Amer. Ent. Soc., XXIX, p. 271. [Southern British Guiana.]

Three males, one female.

The female is slightly larger than the type specimen, but otherwise the series is perfectly typical of the species.

The supra-anal plate of the male is rather produced, trigonal and fissate mesad with the incision a mere slit to very near the apex; cerci about half again the length of the subgenital plate, tapering in the distal two-thirds; subgenital plate not reaching the caudal margin of the supra-anal plate, trigonal, supplied with lateral styles nearly a third the length of the cerci.

*Measurements of Male.*

Length of body, . . . . .	22.5 mm.
Length of pronotum, . . . . .	5.5 "
Greatest width of pronotum, . . . . .	6.5 "
Length of tegmen, . . . . .	21.2 "
Greatest width of tegmen, . . . . .	6 "

*Epilampra maculicollis* (Serville).

1839. *Blatta maculicollis* Serville, Orthoptères, p. 92. [Brazil.]

One male, one female.

The base color of these specimens is maize yellow, and between the eyes the head bears dorsad a pair of tapering spots of mummy brown, ventrad a blotch of seal brown, which has laterad short bars of the same color extending ventrad between the antennæ. The pronotum is very finely sprinkled with, and the delicate pattern traced, in vandyke brown, while the tegmina have the discoidal and anal areas very thickly flecked with large and small spots of burnt umber, the basal and costal regions being comparatively clear with only small spots.

***Epilampra fusca* Brunner.**

1865. *Epilampra fusca* Brunner, Nouv. Syst. Blatt., p. 170. [Venezuela.]

One female.

As far as can be determined from Brunner's description, which was based on a mutilated specimen, this individual appears to represent the species.

The color pattern is rather regular and typical of the genus, the maculations of the tegmina being uniformly distributed but larger in the discoidal field, while the whole insect has a strong suffusion of raw sienna. The head bears two spots of seal brown between the eyes, these spots being connected by a line of the same color which encloses a quadrate area between the antennæ.

*Measurements.*

Length of body, . . . . .	41.5 mm.
Length of pronotum, . . . . .	9.2 "
Greatest width of pronotum, . . . . .	11.5 "
Length of tegmen, . . . . .	38.5 " }
Greatest width of tegmen, . . . . .	12 " }

**PERIPLANETA** Burmeister.***Periplaneta australasie* (Fabricius).**

One male, two females.

**CHORISONEURA** Brunner.***Chorisoneura gracilis* (Saussure).**

1862. *Blatta gracilis* Saussure, Revue et Magasin de Zoologie, 2e ser., XIV, p. 167. [Brazil.]

One damaged specimen.

**PYCNOSCELUS** Scudder.***Pycnoscelus surinamensis* (Linnaeus).**

Two females.

One individual is quite uniform blackish above, with the cephalic margin of the pronotum laterad and the marginal field of the tegmina ochraceous.

**PANCHLORA** Burmeister.***Panchlora viridis* (Fabricius).**

1775. [*Blatta*] *viridis* Fabricius, Syst. Entom., p. 272. [America.]

One male.

This species has previously been recorded from Cayenne.

***Panchlora peruana* Saussure.**

1864. [*Panchlora*] *Peruana* Saussure, Revue et Magasin de Zoologie, 2e ser., XVI, p. 342. [Peru.]

One male, two females.

The female individuals differ somewhat in size, but both appear referable to this species.

*Measurements of Females.*

Length of body, . . . . .	20.4 mm.	21.5 mm.
Length of pronotum, . . . . .	5.2 "	6 "
Greatest width of pronotum, . . . . .	6 "	7.3 "
Length of tegmen, . . . . .	19.5 "	22.6 "
Greatest width of tegmen, . . . . .	5.2 "	6.5 "

**Holocompsa** Burmeister.

**Holocompsa nitidula** (Fabricius).

1781. [*Blatta*] *nitidula* Fabricius, Spec. Ins., I, p. 345. [Surinam.]

Two females.

These specimens have a dark brown patch on the caudal section of the disk, and the caudal margin of the pronotum is narrowly suffused with the same color. This pattern of coloration is evidently present in the type of Fabricius as he states: "Thorax ferrugineus, nitidus macula baseos nigra." The golden hairs which are present on the lighter sections of the pronotum are also distributed over the brown area.

**Holocompsa cyanea** Burmeister.

Two males.

This species has been recorded from Brazil by Brunner.

**Blaberus** Serville.

**Blaberus posticus** Erichson.

1848. *Blabera postica* Erichson, in Schomburgk's Reisen Brit. Guiana, III, p. 580. [British Guiana.]

One female.

This specimen is the first of a number of individuals of this section of the genus examined by the author, which appears to fit Erichson's very poor description. The pronotal maculation is confluent laterad with the blackish caudal margin. This character appears to be what Erichson refers to in "Der Halsschild mit spitzer gerundeten Seiten, auf dem Rücken mit einigen kleinen, unbestimmten schwarzen Flecken, dagegen der Hinterrand breit schwarz gesäumt." The figure of *B. thoracicus* given by Saussure and Zehntner represents very nearly the same thing, but a specimen from Costa Rica which I had considered *thoracicus*<sup>3</sup> has these lateral bars lacking. Kirby's synonymizing of

<sup>3</sup> *Proc. Acad. Nat. Sci. Phila.*, 1905, p. 792.

the two species would appear, from the evidence in hand, to be correct, The author's *B. biolleyi*<sup>4</sup> differs from *posticus* in the paler coloration, the more numerous and finer veins of the anal area of the tegmen and the separate and distinctly outlined maculations of the pronotum.

### MANTIDÆ.

#### ACONTISTA Sauseure.

*Acontista perspicua* (Fabricius).

1787. [*Mantis*] *perspicua* Fabricius, Mant. Insect., I, p. 230. [Cayenne.]

One male, one female.

This species is known only from the Guianas.

*Angela guianensis* n. sp.

Types: ♂ and ♀; Demarara, British Guiana. 1901. (R. J. Crew.)

Closely allied to *A. quinque maculata* (Stoll) from Cayenne, but differing in the coloration of the wings in both sexes, particularly in the absence of yellow in the male, and also in the short tegmina and wings of the female. From *brachyptera* (Stoll) it can be separated by the unspined margins of the caudal section of the pronotum and the tuberculate abdomen, as well as the color of the wings of the male. The coloration of the wings of *fulgida* and *trifasciata* readily separates the new form from these species.

Size rather large; form as usual in the genus, male bacilliform with elongate tegmina and wings, female elongate with quite short tegmina and wings; surface smooth but not polished.

♂. Head strongly transverse, occipital outline straight except for a pair of slight lateral depressions; eyes prominent, ovoid in outline when viewed laterad, rounded and projecting slightly cephalad of the general level of the face but nearly plane caudad; ocelli large, elliptical, placed in a low, broad triangle; facial scutellum arcuate transverse, the arcuation dorsad; antennæ as long as the head and pronotum together, moderately serrulate. Pronotum with the coxal dilation slight, subequal cephalad and caudad of the same; lateral margins of the collar distinctly dentate, of the shaft slightly dentate cephalad, smooth caudad; median carina distinct throughout the length of the pronotum but quite delicate on the collar, the shaft compressed trigonal in section. Tegmina slightly longer than the head and pronotum, when in repose reaching nearly to the tip of the third abdominal segment; margins subparallel, apex rounded acute-angulate, the sutural margin being considerably trimmed toward the apex; costal field moderately expanded proximad and very gradually narrowing distad;

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<sup>4</sup> *Ibid.*, p. 702.

ulnar vein with three almost parallel rami, stigma distinct. Wings exceeding the tegmina by about a third the length of the pronotum, slightly longer than twice the width; costal margin nearly straight, apex rather narrowly rounded. Cephalic coxæ slightly less than half the length of pronotum, not armed; cephalic femora about five-eighths the length of the pronotum, the ventro-caudal margin bearing four large and one small distal spines, the ventro-cephalic margin armed with two grades of spines, the larger size numbering six and the smaller eight, the smaller being placed one each between the larger spines, except that distad of the distal large spine two small ones are present and between the first and second distal spines three are present, discoidal spines four in number; cephalic tibiæ (exclusive of terminal claw) less than a third the femoral length, the cephalic margin with sixteen spines increasing in size distad, caudal margin with five spines; tarsi about equal to the tibiæ in length. Median and caudal limbs very slender but not greatly elongate, the caudal femora not quite reaching the middle of the third abdominal segment.

General color Prout's brown. Tegmina hyaline washed narrowly along the sutural margin (distad of the dividing vein) and very broadly along the costal margin with Prout's brown, the greater portion of all the longitudinal veins being marked with numerous fine linear seal brown touches. Wings with proximal half hyaline, the apex of the anterior field yellowish coriaceous, the remainder vandyke brown with very strong violet reflections, this coloration also extending nearly to the base as a varying line along the mediastine vein, the caudal section of the broad transverse bar extending clear to the margin, and broken only by less infusate areas immediately surrounding the radiate veins and the clear pattern of the transverse veins.

♀. Head much as in the male, facial scutellum slightly less arcuate; antennæ very short, hardly exceeding the length of the collar of the pronotum, filiform. Pronotum with the collar nearly a fifth the length of the whole pronotum, coxal dilation slight; collar slightly tapering cephalad, the cephalic angle narrowly rounded and with an apparent elevation caused by a marked depression of the collar immediately caudad; lateral margins of the collar dentate, shaft with the margins unarmed; median carina distinct on the collar and on the cephalic and caudal sections of the shaft, collar trigonal in cross section, shaft rounded dorsad. Tegmina about a fifth the length of the pronotum, reaching in repose to about the middle of the first abdominal segment, margins very slightly approximate distad; apex broadly rounded, stigma distinct. Wings in repose extending beyond the tegmina by not quite a third

the length of the latter, the length but slightly greater than the length of the tegmen. Abdomen with the apex broad, depressed, the three terminal segments with very distinct median longitudinal marginal folds; supra-anal plate about as long as broad, the distal portion rounded; cerci broad, lamellate and truncate as usual in the genus; subgenital plate strongly compressed, rostrate, diverted ventrad out of the general abdominal plane. Cephalic coxæ slightly less than half the length of the pronotum, slightly armed, distal section expanded and compressed, being abruptly trigonal in section, while the proximal three-fourths is transverse in section; cephalic femora slightly more than half the length of the pronotum, the margins armed as in the male except that the cephalic margin has one or two additional spines of the second order; tibiæ and tarsi as in the male. Median and caudal limbs slender but not greatly elongate.

General color tawny-olive finely washed, spotted and sprinkled with Prout's brown; eyes marked with seal brown. Pronotum with the two colors showing very distinctly in a pattern which is pardaline in character, the shaft with its cephalic fifth inclined toward bistre. Tegmina tawny-olive in the proximal half, becoming brick red in the distal half, the costal section Prout's brown, some of the rami of the ulnar vein and the dividing vein with short fine linear touches of bistre, the folded proximal section blackish purple. Wings with the anterior field broccoli brown, yellowish along the costal margin and rich brick red in the distal third; posterior field with the base color purplish brown with a very strong purplish-blue sheen, bearing two irregular maculations of lemon yellow, limited to about the cephalic half of the field and each bearing distad an area of equal size of the clear base color of the area, the whole wing except these areas and the semi-coriaceous red section of the anterior field having all the transverse veins white or yellowish-white. Abdomen of the general color; limbs of the general color with the pardaline appearance distinctly marked on the median and caudal limbs.

*Measurements.*

	♂	♀
Length of body, . . . . .	67.5+ mm.	88 mm.
Length of pronotum, . . . . .	25 "	36.5 "
Greatest width of pronotum, . . . . .	2.3 "	3 "
Length of tegmen, . . . . .	28.5 "	13.9 "
Length of wing, . . . . .	34 "	13.5 "
Length of cephalic femur, . . . . .	14.8 "	20.3 "

The types are the only specimens seen by the author.

**PHOTINA** Burmeister.

1838. *Photina* Burmeister, Handb. d. Ent., II, Abth. II, pt. I, p. 531.

Type, by elimination, *P. vitrea* Burm.

**Photina vitrea** Burmeister.

1838. *M[antis] (Photina) vitrea* Burmeister, Handb. d. Entom., II, Abth. II, pt. I, p. 532. [Brazil.]

One female.

**PARAMUSONIA** Rehn.**Paramusonia conspersa** (Saussure).

1870. *Th[espis] conspersa* Saussure, Mitth. Schw. Ent. Gesell., III, p. 238. [South America.]

One male, one female.

Apparently this is the first record of the species with exact data. This form can be separated from the allied *P. infumata* (Serville) by the finely denticulate lateral margins of the pronotum.

**MIOPTERYX** Saussure.**Miopteryx grenadensis** Saussure.

Two males.

**CALLIBIA** Stål.

1877. *Callibia* Stål, Bihang till K. Svenska Vet. Akad. Handl., IV, No. 10, pp. 79, 85.

Type.—*Harpax pictipennis* Serville = *Mantis diana* Stoll.

**Callibia diana** (Stoll).

1813. [*Mantis*] *Diana* Stoll, Natuur. Afbeeld. Besch. Spoken, pp. 74, 78, pl. XXV, fig. 100. ['East Indies.']

One male.

This species has been recorded from Cayenne.

**OXYOPS** Saussure.

1869. *Oxyops* Saussure, Mitth. Schw. Ent. Gesell., III, pp. 56, 66.

Type.—*O. rubicunda* (Stoll).

**Oxyops rubicunda** (Stoll).

1813. [*Mantis*] *Rubicunda* Stoll, Natuur. Afbeeld. Besch. Spoken, pp. 73, 79, pl. XXV, fig. 96.

One male.

This specimen has the internal face of the cephalic coxæ unicolor as in one of the males examined by Saussure.

**PARASTAGMATOPTERA** Saussure.**Parastagmatoptera tessellata** Saussure and Zehntner.

1894. *Parastagmatoptera tessellata* Saussure and Zehntner, Biol. Cent.-Amer., Orth., I, p. 188. [Cayenne.]

One male.



## PHASMIDÆ.

## CEROYS Serville.

1839. *Ceroys* Serville, Orthoptères, p. 262.

Type.—*C. perfoliatus* (Gray).

*Ceroys lituus* n. sp.

Type: ♀; Demerara, British Guiana. 1901. (R. J. Crew.)

Not closely allied to any previously known species of the genus, differing in the absence of spines and in the lobation of the median and caudal femora. This species may not be true *Ceroys*, but it does not belong to any of the present allied genera.

Size median; form moderately robust; surface smooth, not polished, unarmed. Head rather long, subequal caudad of the eyes, occiput with a faint median longitudinal impressed line and several very weak ones laterad; eyes subglobose, moderately prominent; antennæ filiform, about equal to the head and thorax in length, the proximal joint depressed. Pronotum nearly half again as long as broad, the lateral margins somewhat incurved, cephalic margin moderately concave, caudal margin arcuate, transverse depression distinct, arcuate caudad, median longitudinal depression very faint and incomplete. Mesonotum five and a half times the length of the pronotum, a distinct dorsal line present but no carina. Metanotum (including median segment) about five-eighths the length of the mesonotum, the median segment very distinctly longer than broad and exceeding the length of the remainder of the metanotum. Abdomen distinctly exceeding the remainder of the body in length; four proximal joints simple, longitudinal and very slightly increasing in length distad; fifth segment expanded meso-caudad, in length about equal to the fourth segment; sixth segment simple, slightly shorter than the first proximal segment; seventh segment two-thirds the length of the sixth, somewhat expanded caudad; eighth segment slightly shorter than the seventh; ninth segment shorter than the eighth, compressed, carinate dorsad, narrowly emarginate caudad; supra-anal plate with the angulate tip alone visible; cerci compressed, tapering, blunt, the length about two-thirds that of the ninth dorsal segment; subgenital opercule boat-shaped, carinate in the distal half, lanceolate, acute, not exceeding the tips of the cerci. Limbs multicarinate, robust. Cephalic femora about as long as the mesonotum, compressed, basal flexure very marked and abrupt, the two prominent dorsal and single ventral carina lamellato-carinate; cephalic tibiæ about equal to the femora in length and with three lamellate carinæ; tarsi with the proximal joint slightly longer than the remaining joints. Median femora slightly shorter than the metanotum, the two

ventral lamellate carinæ each with a prominent proximal and distal rounded foliaceous lobe, the dorso-cephalic carina also with a low proximal lobe; median tibiæ about as long as the femora, the ventral carinæ lamellate, but no lobes present; median tarsi with the proximal joint about equal to the remaining joints. Caudal femora as long as the proximal two and a half abdominal segments, in structure similar to the median but with the dorsal lobe even smaller; caudal tibiæ slightly longer than the femora, in structure similar to the median tibiæ but slightly slenderer; caudal tarsi with the proximal joint distinctly but not greatly longer than the remaining joints.

General color Prout's brown obscurely marked on the head and limbs with bistre, the femoral lobes and extremities of the median and caudal tibiæ decidedly bistre; antennæ wood brown sprinkled with the general color.

*Measurements.*

Length of body, . . . . .	101 mm.
Length of pronotum, . . . . .	4.5 "
Length of mesonotum, . . . . .	24.5 "
Length of metanotum (including median segment), . . . . .	16 "
Length of cephalic femur, . . . . .	22.5 "
Length of median femur, . . . . .	14 "
Length of caudal femur, . . . . .	17.3 "

The type is unique.

**OLCYPHIDES** Griffini.

***Olcypoides fasciatus*** (Gray).

1835. *P[hasma] fasciatum* Gray, Synopsis Phasm., p. 24. [Brazil.]

One female (sex ?).

This individual is broken, but I presume it is a female. The original description, while very brief, sums up the chief diagnostic characters of the species.

## DESCRIPTIONS OF FIVE NEW SPECIES OF ORTHOPTERA FROM TONKIN.

BY JAMES A. G. REHN.

## PHASMIDÆ.

*Phryganistria grandis* n. sp.

Type: ♂; Tonkin, Indo-China. [A. N. S. Phila.]

Allied to *P. sarmentosa* Westwood from Sylhet, but differing in the larger size, the greater number of medium-sized spines on the ventral margins of the median and caudal femora, and the presence of a strong distal spine on each of the same margins, as well as the proportionately slenderer abdomen.

Size very large; form very slender; surface glabrous. Head about equal to the pronotum in length, somewhat narrowed caudad, and with the caudal section of the occiput with four longitudinal subparallel impressed lines; eyes rather prominent, globose; ocelli absent; antennæ when extended caudad reaching nearly to the caudal margin of the second abdominal segment, first antennal joint moderately depressed. Pronotum distinctly longer than broad; cephalic margin slightly arcuate-emarginate, caudal margin subtruncate; transverse depression slightly bent caudad in the middle, a faint trace of a longitudinal depression in the cephalic section, none in the caudal section. Mesonotum but little shorter than the metanotum, median segment and first segment of the abdomen nearly seven times the length of the pronotum, subequal except in the caudal fourth where it is slightly and gradually expanded. Metanotum (including median segment) slightly more than two-thirds the length of the mesonotum; median segment slightly less than a third the length of the remainder of the metanotum; cephalic half subequal, evenly expanding in the caudal half. Abdomen exceeding the head and thoracic segments in length by more than the length of the head, as a whole subequal in width, the slight enlargement of the segments at their articulation with contiguous segments giving the abdomen the appearance of a section of bamboo; first segment very slightly longer than the head and pronotum together, second and third subequal and slightly longer than the first, fourth and fifth subequal and slightly longer than the second and third, sixth segment two-thirds the length of the fifth,

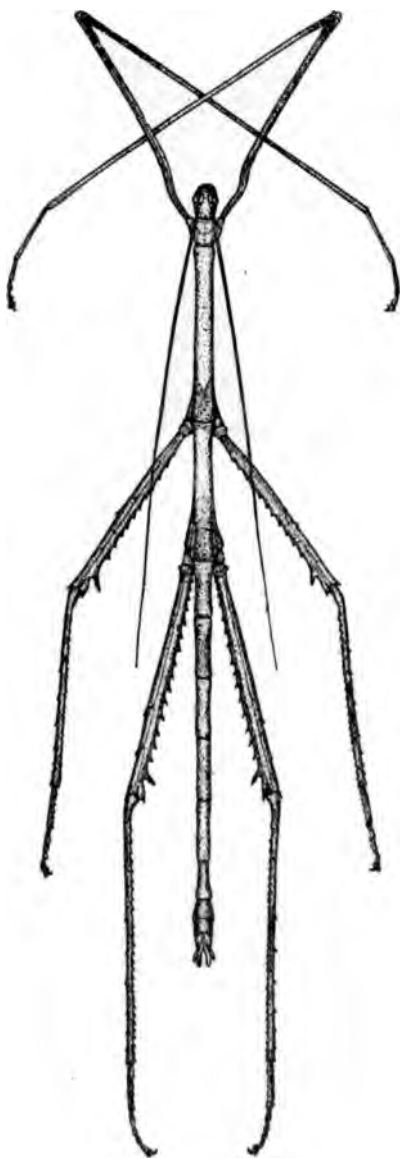


FIG. 1.—*Phryganistria grandis* n. sp.  
Dorsal view of male type. (One-half natural size.)

seventh segment about half the length of the sixth, compressed and deep, eighth segment compressed, as deep as and slightly shorter than the seventh segment, ninth segment with its extreme length about equal to the seventh and eighth united, strongly compressed, tectate and carinate dorsad, bearing two lateral digitiform processes which enclose a deep V-shaped emargination, the processes being rounded distad and bearing a number of short recurved spines on their inner faces; cerci slender, simple, strongly curved distad; subgenital opercule extending to the apex of the eighth dorsal segment, not produced, the distal margin straight, the dorsal margin rounded-angulate, the ventro-caudal angle blunt-rectangulate. Cephalic femora slightly longer than the head, pro- and mesonotum, somewhat compressed, multicarinate, basal flexure short but very distinct, dorso-cephalic margin with a number (14 to 18) of rather irregularly distributed spines; cephalic tibiae considerably exceeding the femora in length, as long as the six proximal abdominal segments in length, very slender and with the margins unarmed; cephalic metatarsi distinctly longer than the remaining segments of the tarsi

united; arolia present. Median femora in length equal to the

mesonotum and half of the pronotum, rather robust, strongly carinate, the dorsal carinae with a few short spines on each but the caudal with a greater number than the cephalic, ventral margins with a series of strong spines, 12 to 14 in number, in addition to which is placed distad a very strong acute spine, the genicular lobes are spiniform and the ventral face bears a median longitudinal series of 6 or 7 fine spines; median tibiae very slightly longer than the femora, slightly curved proximad, all the margins spined but the ventrals with a much greater number than the dorsals; metatarsi about equal to the remaining tarsal joints, all more robust than in the cephalic limbs. Caudal femora reaching nearly to the apex of the fourth abdominal segment, dorsal margins with very few spines, ventral margins armed as the median femora, the large distal spine and genicular lobes similar in form, and the lateral series numbering 16 to 17 spines, the median ventral series 9 to 10 in number; caudal tibiae similar to the median in structure but longer; caudal metatarsi distinctly longer than the remaining tarsal joints.



FIG. 2.—*Phryganistria grandis* n. sp. Lateral view of the apex of male abdomen. (Natural size.)

General color ferruginous, pale on the head and distad on the abdomen, the greater portion of the mesothorax and the cephalic section of the metathorax wood brown, the former washed with malachite green. Antennae blackish brown. Ventro-lateral margins of the median and caudal femora dull oil green; spines tipped with black.

#### Measurements.

Length of body, . . . . .	198 mm.
Length of head, . . . . .	7.5 "
Length of pronotum, . . . . .	7 "
Length of mesonotum, . . . . .	46 "
Length of metanotum (including median segment), . . . . .	34.5 "
Length of cephalic femur . . . . .	63.8 "
Length of median femur, : . . . . .	48.5 "
Length of caudal femur, . . . . .	58 "
Length of caudal tibia, . . . . .	70.5 "

The type only has been examined.

#### TETTIGONIDÆ.

*Chondrodora*<sup>1</sup> *maxima* n. sp.

Type: ♀; Tonkin, Indo-China?<sup>2</sup> [A. N. S. Phila.]

<sup>1</sup> It appears from the literature on this genus that Brunner misinterpreted the shape of the mesosternum and metasternum, and should have placed this genus, in his revision of the *Pseudophyllinae*, under 4 instead of 4<sup>1</sup> of the *Phyllomimi*.

<sup>2</sup> Some doubt is attached to this locality.

Allied to *C. notatipes* and *C. subvitrea* Karsch from West Africa, but differing in the greater size, the deeper lateral lobes of the pronotum, the smaller eye, the differently shaped tegmen and the lesser number of transverse veins in the same. From *C. borneensis* Brunner it is readily separated by the presence of a longitudinal spurious vein in the anal field of the tegmen, and in the strongly spined and but slightly ciliate femora.

Size moderately large; form generally compressed. Head broad, somewhat flattened cephalad; occiput not elevated, straight, rounded

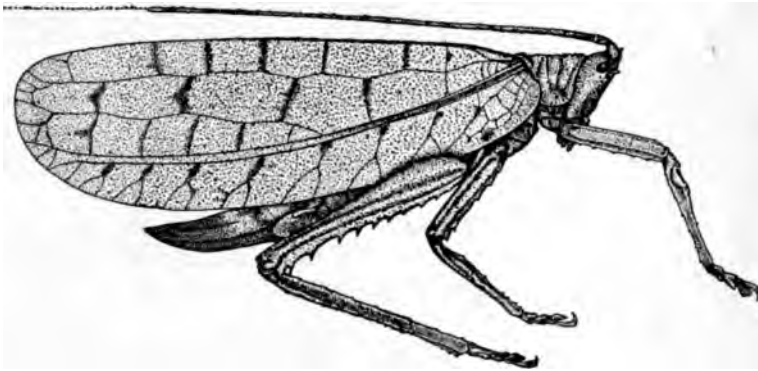


FIG. 3.—*Chondrodera maxima* n. sp. Lateral view of type. ( $\times 1\frac{1}{2}$ .)

transversely; fastigium produced, extending slightly beyond the antennal scrobes, acute, moderately sulcate distad; eyes rather small, exserted and quite prominent, subglobose; antennæ with the margins of the scrobes touching mesad, first joint large, subcylindrical, joints beyond the second poorly defined, in an incomplete condition extending to the distal third of the tegmen. Pronotum somewhat saddle-shaped, the lateral lobes moderately flaring ventrad, surface with a number of blunt tubercles; cephalic margin obtuse-angulate with the immediate angle truncate, caudal margin arcuate with a slight median emargination; longitudinal median sulcus distinct, precurrent, bearing in its depression a blunt median carina on the prozona (proper) and metazona, on the latter becoming more conspicuous caudad by the shallower character of



FIG. 4.—*Chondrodera maxima* n. sp. Dorsal view of female pronotum. ( $\times 2$ .)

the sulcus; median sulcus flanked through nearly its entire length by a pair of series of rather irregularly placed tubercles; sulci separating the prozona, mesozona and metazona very distinct and deep, the meso-

metazonal one particularly heavy; lateral portions of the caudal margins of the disk somewhat elevated; lateral lobes slightly longer than deep, caudal margin with a distinct but shallow elytral sinus, ventral margin sinuate obtuse-angulate, the margin supplied with low tubercles which are the terminations of low subobsolete ridges radiating from a point on the ventral section of the lateral lobes. Prosternum unarmed. Mesosternum distinctly but not greatly transverse, the foramina large and well separated. Metasternum strongly transverse, the cephalic margin slightly broader than the mesosternum, caudal section regularly narrowed, the foramina nearer the caudal margin, transverse and connected by a rather broad sulcus. Tegmen rather coriaceous in texture, the greatest width (excluding the anal field) contained slightly more than three times in the length; dorsal outline when viewed laterally (excluding the horizontal anal field) nearly straight, costal margin slightly arcuate cephalad, strongly arcuate distad; apex dorsad and rather narrowly rounded, costal field with a distinct rounded proximal lobe; costal field with the mediastine vein short, oblique, anterior radial vein sending nine principal oblique rami to the costal margin, the most of which are bifurcate in the distal portion of their length; radial ramus issuing distinctly but not greatly proximad of the middle of the tegmen, the area between this and the posterior radial vein with six principal transverse veins, which enclose areas roughly quadrate in shape; anterior ulnar vein undulate, reaching to the apex of the tegmen, the area between the radial ramus and this vein having five principal transverse veins; area between the two ulnar veins with seven principal transverse veins; anal area narrow but continued to very near the apex of the tegmen, and bearing in addition to one principal precurrent though erratic longitudinal vein several others of similar character in the proximal section, short transverse veins numerous. Wings in repose reaching almost to the tips of the tegmina. Abdomen moderately compressed; supra-anal plate slightly longitudinal, rounded, the apex emarginate and a shallow longitudinal median depression is present on the proximal half, ciliate; ovipositor about twice as long as the pronotum, heavy, hardly curved, the dorsal margin nearly straight and with a slight basal emargination, ventral margin regularly arcuate, apex acute, dorsal margin and short distal section of the ventral margin finely serrate; subgenital plate short, transverse trigonal, the apex with a V-shaped emargination. Cephalic femora about as long as the head and pronotum, carinate, the ventral margins with four to six blunt spines; cephalic tibiae slightly longer than the femora, bullae perforate and expanded on both sides, dorsal carinae with one

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short spine on the caudal, ventral carinæ both with a number (6 to 7) of short spines; tarsi with the third joint very broad. Median femora about as long as the cephalic, more compressed, deeper, ventro-cephalic margin strongly carinate and armed with five short spines, ventro-caudal margin armed with a number of very small spines, the margin not strongly carinate like the ventro-cephalic; median tibiæ slightly longer than the femora, compressed, carinate, ventral margins armed with seven small spines. Caudal femora not quite half the length of the tegmen, moderately compressed, and considerably inflated in the proximal half, cephalic face bearing two longitudinal depressions, ventro-cephalic margin lamellate and armed with ten or eleven flattened spines, which are small proximad and increase to a considerable size distad; caudal tibiæ about equal to the femora in length, compressed, carinate, the dorso-cephalic margin armed with four short spines, the dorso-caudal with twelve to fourteen larger lamellate spines, the ventral margins with about seven rather small spines on each margin.

General color very dull canary yellow, becoming saffron yellow on the limbs. Head touched with saffron yellow; eyes walnut brown; antennæ with widely placed annuli of walnut brown. Pronotum with the median longitudinal area faintly washed with lilac. Tegmina with the principal transverse veins bordered and touched with patches and lines of wine purple, the proximal portion of the sutural margin faintly washed with the same color. Ovipositor clay-color, the distal half and the entire ventral margin seal brown. Limbs with the spines either wholly or in part black.

#### Measurements.

Length of body (exclusive of ovipositor), . . . . .	43 mm.
Length of pronotum, . . . . .	8.5 "
Greatest width (ventral) of pronotum, . . . . .	10 "
Length of tegmen, . . . . .	61 "
Greatest width of tegmen, . . . . .	20 "
Length of caudal femur, . . . . .	27.5 "
Length of ovipositor, . . . . .	19.5 "

The type only has been examined.

#### *Anabropsis*<sup>3</sup> *tonkinensis* n. sp.

Type: ♀; Than-Moi, Tonkin, June-July. (Frühstorfer.) [A. N. S. Phila.]

Allied to *A. frater* (Brunner),<sup>4</sup> supposed to be from India, but differ-

<sup>3</sup> *Schenobates* of authors, cf. Rehn, *Canad. Entom.*, XXXIII, p. 272, 1901.

<sup>4</sup> *Verhandl. K. K. Zool.-bot. Gesell. Wien*, XXXVIII, p. 275.



ing in the smaller size and the fewer spines on the margins of the caudal tibiae, ten instead of fourteen in number. Brunner's species is very briefly described and based on a male, but the specimen in hand differs in the lesser length of the body and of the caudal femora and tibiae, as well as the fewer tibial spines.

Size rather large (compared with American species of the genus); form somewhat compressed; surface entirely glabrous, polished. Head short and broad, occiput rounding toward the fastigium and bearing a very slight median longitudinal sulcus, which is continued nearly to

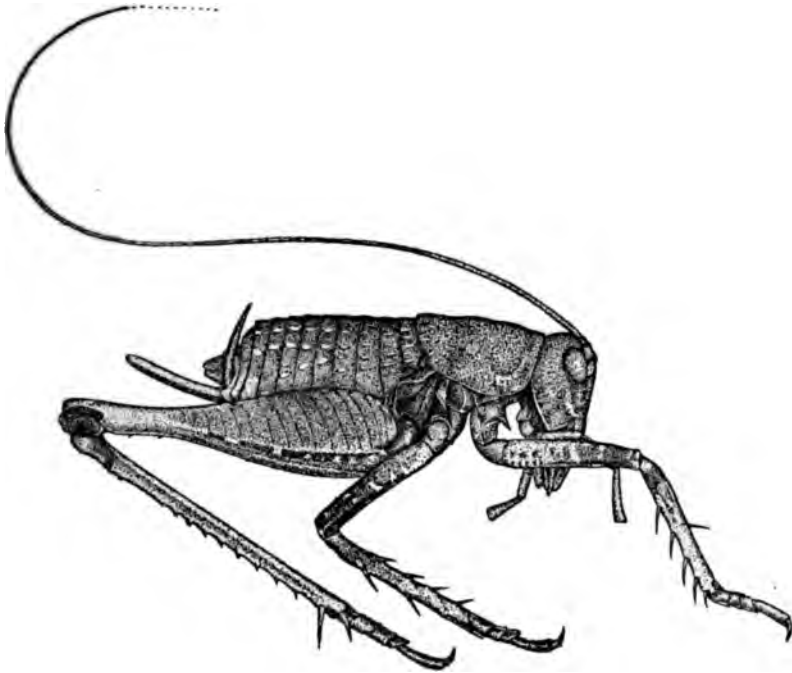


FIG. 5.—*Anabropsis tonkinensis* n. sp. Lateral view of type. (About  $\times 2$ .)

the extremity of the compressed fastigium, which latter is separated from the vertex by a broad and shallow depression; frontal fastigium touching the fastigium of the vertex; paired ocelli large, placed on the lateral faces of the fastigium, median ocellus placed closer to the apex of the facial fastigium than to the clypeal margin; eyes ovoid, flattened cephalad, slightly prominent; antennal scrobes little elevated, proximal and second antennal joints subcylindrical, the second considerably smaller than the first, remainder of the antennae slender, moniliform,

about twice the length of the body, the third joint slightly longer than the proximal and second joint together. Mandibles, clypeus and labrum large and produced as is usual in the genus; palpi large, with the first and second joints subequal, the third slightly longer than the others and distinctly longer than the labrum. Pronotum hardly arched longitudinally, distinctly arched transversely; cephalic margin truncate, caudal margin arcuato-truncate; lateral lobes very greatly longer than deep, the greatest depth in the cephalic section; no median carina present, but an extremely fine median sulcus extends the whole length of the pronotum; distinct transverse sulci two in number, one near the cephalic margin, the other slightly caudad of the middle and extending cephalo-laterad of the axis of the pronotum and forming oblique broad depressed areas on the lateral lobes. Tegmina very minute, not half as long as the exposed lateral portion of mesonotum, pad-like. Mesonotum, metanotum and abdominal segments provided dorsad with a slight but distinct median carina, laterad the distal section of each segment is provided with a number of short welt-like ridges. Supra-anal plate small, trigonal, depressed with the margins elevated; ovipositor rather short and weak, slightly arcuate, tapering, apex moderately acute, margins unarmed. Prosternum with a pair of very long spines, nearly erect, the tips needle-like; mesosternum with a pair of similar spines, which, however, are shorter and broader than those on the prosternum; metasternum with a pair of blunt triangular lobes. Cephalic femora moderately compressed, slightly longer than the pronotum, margins and genicular lobes unarmed; cephalic tibiae slightly longer than the femora, dorsal margins each with a distal spine and the cephalic with one median one, ventral margins each with five spines, the proximo-caudal small, as is also the proximo-dorsal; cephalic tarsi very slightly more than half the length of the tibiae, arolia absent. Median femora equal to the cephalic in length and unarmed; median tibiae very slightly longer than the femora, armed on the dorso-cephalic margin with three spines and on the dorso-caudal with four spines, the ventral margins each armed with five spines. Caudal femora slightly shorter than the length of the body, strongly inflated in the proximal two-thirds, the distal third subequal, pagina sculptured with a regular series of clear-cut oblique lines, caudo-ventral margin with five to seven short spines on the distal section; caudal tibiae about as long as the femora, dorsal margins each armed with ten fixed spines, ventral margins armed with three short mobile spines on the cephalic margin and one on the caudal margin, while three pairs of distal spurs are present, the proximal being very large

on each margin and spiniform; caudal tarsi with the distal joint about equal to the proximal in length.

General color dorsad seal brown, ventrad including the limbs pale orange-ochraceous. Head solid color dorsad, ventrad of the dorsal color laid over cream-buff, the facial fastigium clear cream-buff; mouth parts, except clypeus, of the ventral color; eyes broccoli brown; antennæ of the ventral color except for the three proximal segments which maculate or suffuse with seal brown. Pronotum slightly sprinkled with buffy laterad. Abdomen with the welt-like ridges buffy, as are also the styles and ovipositor. Cephalic and median femora strongly blotched and suffused with seal brown distad; median and caudal tibiæ with proximal section washed with seal brown. Caudal femora with the pagina sprinkled with seal brown, the carina immediately ventrad of the pagina strongly blotched with the same in the proximal two-thirds and the genicular lobes and arches of the same color; caudal tibiæ with the genicular region touched with seal brown. All spines and spurs narrowly tipped with seal brown.

#### Measurements.

Length of body (exclusive of ovipositor), . . . . .	28.5 mm.
Length of antennæ, . . . . .	circa 62 "
Length of pronotum, . . . . .	9.5 "
Length of caudal femur, . . . . .	25 "
Length of ovipositor, . . . . .	8.5 "

The type alone has been examined.

#### *Diestrammena longipes* n. sp.

Type: ♂; Than-Moi, Tonkin. June-July. (H. Frühstorfer.) [A. N. S. Phila.]

Allied to *D. unicolor* Brunner<sup>5</sup> from Siberia, China and Tenasserim, but differing in the very much longer limbs and the very marked coloration.

Size rather large; body in life probably covered in the greater part with golden scales, of which traces remain. Head short, broad and deep; occiput slightly rounded into the fastigium, which is short, rather broad, deeply sulcate and bifurcate; frontal fastigium low, separated from the fastigium of the vertex by a considerable space; ocelli small; eye ovate, flattened cephalad, moderately prominent, considerably shorter than the infra-ocular portion of the genæ; antennal scrobes not elevated, proximal joint short subcylindrical, second joint smaller, subcylindrical, remainder moniliform, very nearly five and one-half times

<sup>5</sup> *Verhandl. K. K. Zool.-bot. Gesell. Wien*, XXXVIII, p. 299.

the length of the body; mandibles, clypeus and labrum moderately prolonged; palpi long and slender, the proximal joint quite short, the second and third longer and subequal, the distal slender, gradually enlarging, over half again as large as the second. Pronotum arched transversely and with faint indications of lateral shoulders; cephalic margin truncate, caudal margin subtruncate; lateral lobes slightly longer than deep, the cephalic section of the margin oblique, mesad

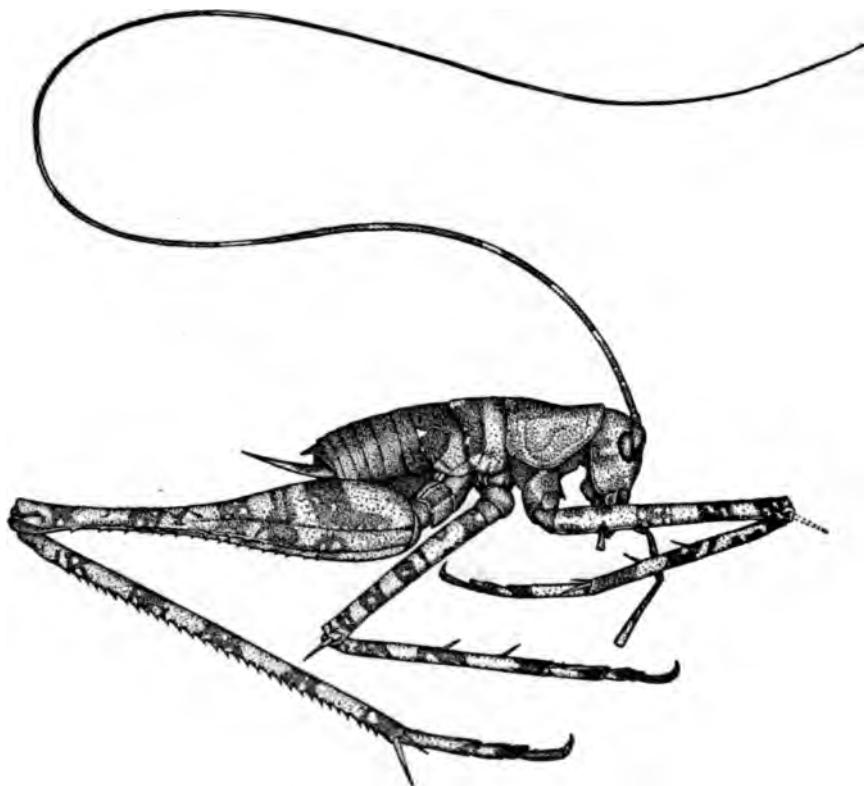


FIG. 6.—*Diestrammena longipes* n. sp. Lateral view of type. ( $\times 2$ .)

with a rounded obtuse angle and caudad with the same, the caudal margin itself nearly straight. Mesonotum with the caudal margin obtuse-angulate; metanotum very slightly obtuse-angulate. Abdomen slightly tectate; cerci styliiform, slightly shorter than the pronotum. Cephalic femora very slightly longer than the head and thoracic segments, armed on the ventro-cephalic margin with three spines and on the

cephalic genicular lobe with one; cephalic tibiae equal to the femora in length, unarmed dorsad except for a short distal spine on the caudal margin, ventral margins each armed with two mobile spines, the distal ventral margin with one short median spine, spurs two in number, comparatively short, subequal; cephalic tarsi compressed, two-thirds the length of the tibiae, metatarsi slightly longer than the remaining joints, distal joint much slenderer than the others, arolia absent. Median femora very slightly shorter than the head and thoracic segments, ventro-cephalic margin with a single spine in the distal section, ventro-caudal margin unarmed, both genicular lobes with large mobile spines, that of the cephalic lobe slightly shorter than the other; median tibiae somewhat longer than the femora, the ventral margin with four paired spines and one median one on the distal margin, spurs rather short, the caudal the longer and that not more than a third the length of the metatarsus; tarsi similar to the cephalic. Caudal femora elongate, nearly half again as long as the body, considerably inflated in the proximal half, slender in the distal half with a slight genicular enlargement, ventro-cephalic face of the proximal inflated portion with several deep longitudinal impressions, the cephalic ventral carina much lower than the caudal, which is moderately lamellate, cephalic armed with ten spines in the distal section, the caudal armed with sixteen spines in the distal two-thirds, genicular lobes each with a very short mesad spine; caudal tibiae slightly longer than the femora compressed, ventral margins unarmed, dorso-cephalic margin with thirty-two fixed spines, dorso-caudal with thirty, spurs in three pairs, the dorsal much the larger and with the caudal one slightly longer than the cephalic and but little shorter than the metatarsus; caudal tarsi similar to the others in structure but slightly larger and more robust.

General color mars brown, the caudal margins of the thoracic and abdominal segments rather irregularly and broadly marked with seal brown, the median sections of the segments, however, being clear or nearly clear mars brown, while the mesonotum and metanotum bear irregular touches of sulphur yellow. Face ventrad of the eyes and of the antennae touched with vandyke brown; eyes walnut brown; antennae seal brown, the proximal joints paler and maculate with seal brown, joints beyond the second with two characters of annulations of lemon yellow, a broad annulation and a number of narrow annulations between each broad one, both characters of annulations becoming distant distad. Limbs with the base color straw yellow with a faint touch of lavender on the proximal portions of the femora, all strongly annulate

with clove brown, the number of annuli on the caudal limbs being four principal ones on the femur, five on the tibia and two on the tarsus.

*Measurements.*

Length of body, . . . . .	21.5 mm.
Length of antenna, . . . . .	circa 118 "
Length of distal joint of the palpus, . . . . .	5.2 "
Length of caudal femur, . . . . .	27.5 "
Length of caudal tibia, . . . . .	29 "

The type is unique.

*Diastrammena palpata* n. sp.

Type: ♂; Than-Moi, Tonkin. June-July. (H. Frühstorfer.) [A. N. S. Phila.]

Allied to *D. unicolor* Brunner and *D. longipes* described above, but differing from *D. unicolor* in the much longer limbs as is the case with *D. longipes*, from which *palpata* differs in the very long palpi and the different coloration.

Size rather large; form somewhat compressed. Head with the occiput descending to the fastigium which is short and deeply, but very narrowly, divided; facial fastigium separated from the fastigium of the vertex by a considerable space; eye elongate subreniform; antennae over five times the length of the body, the proximal joint large, subcylindrical, second joint small and very short, remaining joints moniliform; palpi very slender, elongate, first and second joints short, third and fourth quite long, subequal, fifth very long, over half again as long as the fourth. Pronotum rounded transversely; cephalic margin subtruncate, caudal margin slightly projecting, roundly obtuse-angulate, no lateral angles present; lateral lobes slightly longer than deep, the ventral margin bluntly obtuse-angulate. Mesonotum distinctly obtuse-angulate caudad; metanotum with the caudal margin very slightly arcuate. Abdomen compressed. Cephalic femora somewhat longer than the head and thorax, slender, very slightly expanded proximad, but otherwise subequal, ventral margins unarmed, cephalic genicular lobe with a very short fixed spine, caudal genicular lobe with a long mobile spine; cephalic tibiae very slightly longer than the femora, unarmed dorsad, ventral margins with four paired spines and one median one on the distal border, principal spurs considerably shorter than the large genicular spine on the cephalic femora; cephalic tarsi considerably more than half the length of the tibiae, compressed, the metatarsus slightly more than half the tarsal length, arolia absent. Median femora distinctly but not greatly shorter than the cephalic femora, similar in structure but with a large mobile spine on the cepha-

lic genicular lobe, in length, however, shorter than that on the caudal lobe; median femora and tibiae as in the cephalic limbs but shorter. Caudal femora elongate, slightly more than twice the length of the median, considerably inflated in the proximal half, cephalic ventral margin unarmed, caudal margin with a number of spines, closely

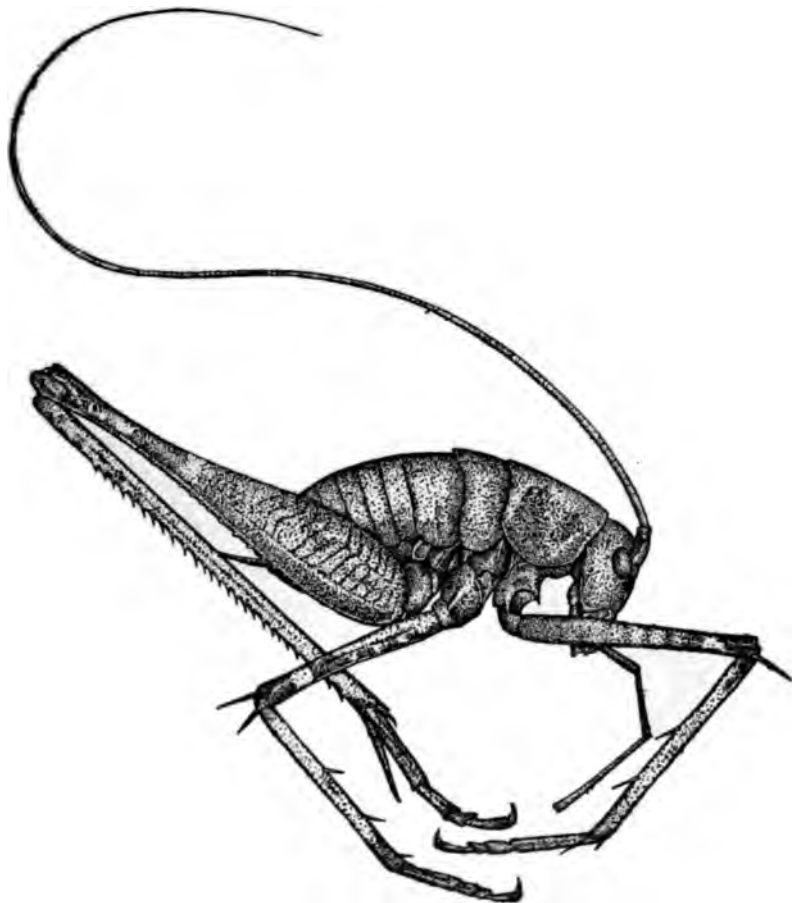


FIG. 7.—*Diestrammena palpata* n. sp. Lateral view of type. ( $\times 2$ .)

placed proximad, sparsely distributed distad; caudal tibiae slightly longer than the femora, dorsal margins with thirty to thirty-four fixed spines, dorsal spurs very large, the caudal as long as the metatarsus; metatarsi about as long as the remaining tarsal joint.

General color burnt umber, meso-dorsal region suffused with clove brown. Eyes vandyke brown; antennae annulate much as *D. longipes*, but the color is duller, the larger annulations narrower and the smaller

ones more numerous; palpi dark except the distal joint which is pale. Cephalic and median limbs cream-buff, proximal three-fourths of the femora obscurely maculate with mummy brown, a clear light pregenicular annulus present, genicular region of the femora and tibiæ seal brown, remainder of tibiæ of the pale ground color. Caudal femora cream buff overlaid and mottled with burnt umber proximad and clove brown distad; caudal tibiæ, except for a certain amount of scattered proximal clove brown maculation, cream buff, spines tipped with dark brown, extreme distal portion of the tibiæ and caudal margins of the tarsal joints washed with seal brown.

*Measurements.*

Length of body, . . . . .	21	mm.
Length of antenna, . . . . .	circa 120	"
Length of distal joint of the palpus, . . . . .	8	"
Length of caudal femur, . . . . .	29	"
Length of caudal tibia, . . . . .	30.5	"

The type is the only specimen examined.



## FURTHER KNOWLEDGE OF SOME HETEROGNATHOUS FISHES. PART I.

BY HENRY W. FOWLER.

In this paper I have attempted to arrange systematically the Heterognathi contained in the collections of the Academy of Natural Sciences of Philadelphia. This group is largely made up of collections formed by John Hauxwell, James Orton and H. H. Smith. Nearly all of Cope's typical specimens, besides a number of comparatively rare or obscurely defined species, are represented. Owing to the increase in knowledge of the vast fresh-water ichthyic fauna of South America, it is believed that further detailed information concerning rare, nominal or species only known from the original specimens will be welcomed.

## ERYTHRINIDÆ.

*Hoplias malabaricus* (Bloch).

*Macrodon trahira* Cope, Proc. Amer. Philos. Soc. Phila., XI 1869-70 (August 19, 1870), p. 566. Pebas. John Hauxwell.—Cope, Proc. Acad. Nat. Sci. Phila., 1871 (January 16, 1872), p. 257. Ambyiacu River. John Hauxwell.—Cope, Proc. Amer. Philos. Soc. Phila., XVII, 1877-78 (May 17, 1878), p. 694. Peruvian Amazon. Prof. J. Orton.  
*Macrodon tareira* Cope, l.c., XXXIII, 1894 (January 5), p. 84. Brazilian province of Rio Grande do Sul. H. H. Smith.

A series of 28 examples represented by those in the Hauxwell and Orton collections from the Ambyiacu and Peruvian Amazons, and the H. H. Smith collection from Rio Grande do Sul, also others from Bahia, Rio das Velhas and Surinam. They show: Head  $2\frac{3}{4}$  to  $3\frac{1}{4}$ ; depth  $3\frac{1}{2}$  to  $5\frac{1}{2}$ ; D. II or III, 10 I to 12 I, mostly 11 I, and only rarely 10 I or 12 I; A. II or III, 8 I or 9 I, most always 8 I, or only rarely 9 I; scales 36 to 42 in lateral line to base of caudal, with 2 to 4 more on latter; 6 scales obliquely back from origin of dorsal to lateral line, only rarely 5; between lateral line and base of ventral 5 or 6 scales, usually 5; 15 to 19 scales before dorsal; snout 4 to  $4\frac{1}{2}$  in head, measured from tip of upper jaw; eye  $4\frac{1}{2}$  to 8; maxillary  $1\frac{1}{2}$  to  $2\frac{1}{10}$ ; interorbital  $3\frac{1}{2}$  to  $4\frac{1}{2}$ ; total length of body  $2\frac{1}{2}$  to  $12\frac{1}{2}$  inches.

OPHIOCEPHALOPS subgen. nov.

Type *Erythrinus unitæniatus* Agassiz.

Dorsal fin rounded or posterior rays not elevated.

(*Ophiis*, serpent; *εὐφελίς*, head; *ὥψ*, appearance.)

**Erythrinus unitaeniatus** Agassiz.

*Erythrinus salmoneus* Cope, Proc. Amer. Philos. Soc. Phila., XVII, 1877-78 (May 17, 1878), p. 694. Peruvian Amazon. Prof. J. Orton.

Head 3 to  $3\frac{1}{2}$ ; depth  $3\frac{1}{2}$  to  $4\frac{1}{2}$ ; D. II, 8 I; A. II, 7 I to II, 9 I, usually 8 I and rarely 7 I or 9 I; scales 30 to 32 in lateral line to base of caudal, and 3 to 6 more on latter; 4 scales between origin of dorsal and lateral line, rarely 5; 4 scales between lateral line and ventral; 13 or 14 scales before dorsal, usually 14; snout  $3\frac{1}{2}$  to 4 in head, measured from tip of upper jaw; eye 5 to  $7\frac{1}{2}$ ; maxillary 2 to  $2\frac{1}{2}$ ; interorbital space  $2\frac{1}{2}$  to 3; total length 4 to 12 inches. In all 7 examples from the upper Amazons, Surinam and Paramaribo.

Subgenus ERYTHRINUS Scopoli.

Dorsal fin angular or pointed, and some of posterior rays elevated.

**Erythrinus erythrinus** (Schneider).

*Erythrinus brevicanda* Cope, Proc. Amer. Philos. Soc. Phila., XI, 1869-70 (August 19, 1870), p. 566. Pebas. John Hauxwell.

*Erythrinus brevicauda* Cope, l.c., XVII, 1877-78 (May 17, 1878), p. 694. Peruvian Amazon. Prof. J. Orton.

Head 3 to  $3\frac{1}{2}$ ; depth  $3\frac{1}{2}$  to 5; D. II, 7 I to 9 I, rarely 7 or 8; A. III, 8 I; scales 29 to 32 in lateral line to base of caudal, and 3 or 4 more on latter; 4 scales between origin of dorsal and lateral line obliquely back; 3 or 4 scales between lateral line and ventral; 14 to 16 scales before dorsal; snout  $3\frac{1}{2}$  to 4 in head, measured from tip of upper jaw; eye  $4\frac{1}{2}$  to  $6\frac{1}{2}$ ; interorbital space  $2\frac{1}{2}$  to  $2\frac{3}{4}$ ; total length of body 3 to  $9\frac{1}{4}$  inches. In all 10 examples from the Orton and Hauxwell collections. One example shows the depressed ventral reaching a trifle beyond origin of anal.

**Pyrrhulina laeta** (Cope). Fig. 1.

*Holotaxis laetus* Cope, Proc. Acad. Nat. Sci. Phila., 1871 (January 16, 1872), p. 257. Type No. 8,029, A. N. S. P. Ambyiacu River. John Hauxwell.

As it is in such poor preservation I am forced to omit a number of notes of value. It may be said however beyond dispute that there are two distinct or well developed bands of teeth in the upper jaw. The accompanying figure will portray such information as is possible to make out from the specimen with the assistance of the original account.

**COPEINA** gen. nov.

Type *Pyrrhulina argyrops* Cope.

Teeth in upper jaw uniserial, otherwise close to *Pyrrhulina*.

(Named for the late Prof. Edward Drinker Cope, who studied most of the fishes included in this paper.)

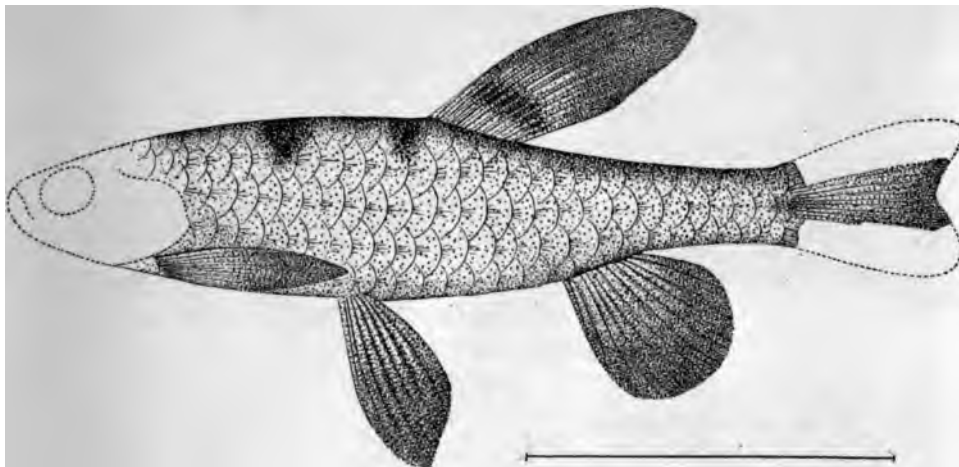


Fig. 1.—*Pyrrhulina lata* (Cope).

***Copeina argyrops* (Cope). Fig. 2.**

*Pyrrhulina argyrops* Cope, Proc. Amer. Philos. Soc. Phila., XVII, 1877-78 (May 17, 1878), p. 694. Nos. 21,441 (type) and 21,442, A. N. S. P., cotypes. Peruvian Amazon. Prof. J. Orton. Coll. of 1877.

About 11? scales (according to pockets) before dorsal; width of head  $1\frac{1}{2}$  in its length; interorbital space  $2\frac{1}{3}$ . Edges of body rounded. Head broadly depressed or flattened above and becoming somewhat constricted below. Snout broadly flattened above. Surface or man-

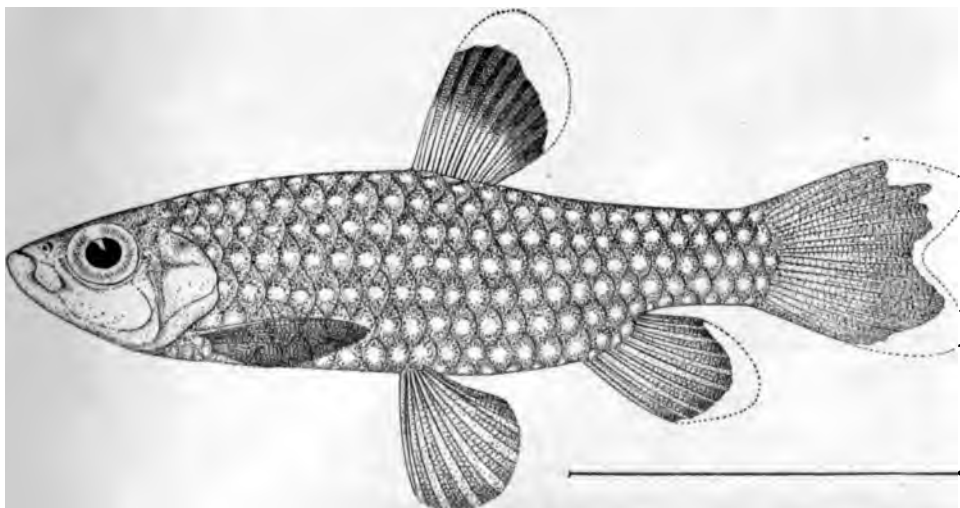


Fig. 2.—*Copeina argyrops* (Cope).

dible well convex. Teeth conic, a little large, uniserial in upper jaw and biserial in lower, though none on maxillary or on roof of mouth. Tongue a little slender or elongate, tip rounded and free. Gill-opening extending forward about opposite front rim of pupil. Rakers  $7+10?$ , lanceolate, a little shorter than filaments which are  $\frac{2}{3}$  of orbit. Isthmus rather narrowly triangular. Each scale with a number of radiating striæ. Color in alcohol plain brown. Upper portion of dorsal more or less blackish with a narrow pale margin. Iris rather brassy. Length  $2\frac{7}{8}$  inches (caudal a little damaged).

#### CHARACIDÆ.

##### CURIMATINÆ.

*Curimatella meyeri* (Steindachner). Fig. 3.

Head  $3\frac{1}{2}$ ; depth about 4; D. iv, 9; A. ii, 8; scales (according to pockets) about 38? in lateral line to base of caudal, and about 5? more on latter; between origin of dorsal and lateral line, obliquely forward, about 5?, and about same number between lateral line and origin of ventral; about 16? scales before dorsal; snout  $3\frac{1}{2}$  in head; eye  $3\frac{1}{4}$ ;

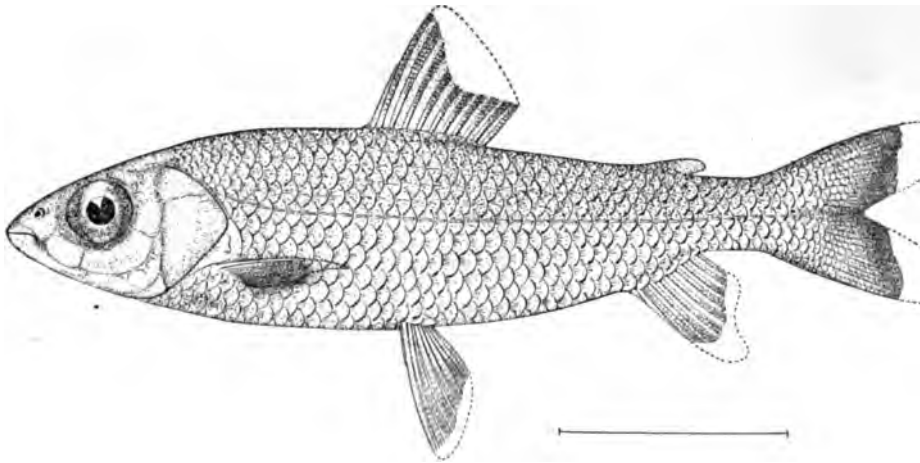


Fig. 3.—*Curimatella meyeri* (Steindachner).

width of mouth 4; maxillary  $4\frac{2}{3}$ ; interorbital space  $2\frac{1}{8}$ ; least depth of caudal peduncle 3. Apparently no rakers. Caudal at present with few scales and these mostly fallen. The color in alcohol, probably due to preservation, is faded brown. This may also account for the absence of spots on the scales of the back. One example (with damaged caudal),  $3\frac{3}{4}$  inches. Peru. Prof. J. Orton. Coll. 1873.

*Curimatella alburnus* (Müller and Troschel).

Head  $3\frac{1}{2}$ ; depth  $2\frac{1}{2}$ ; D. III, 9, 1; A. III, 9, 1; scales 33 in lateral line to base of caudal, and 2 or 3 more on latter; 6 scales obliquely back from origin of dorsal to lateral line; 5 scales between lateral line and origin of ventral; 5 scales between lateral line and origin of anal; snout  $3\frac{1}{2}$  in head; eye  $3\frac{1}{2}$ ; maxillary 3; interorbital space  $2\frac{1}{2}$ ; pectoral  $1\frac{1}{2}$ ; ventral  $1\frac{1}{10}$ . Caudal peduncle deep, compressed, and length about  $\frac{2}{3}$  of least depth. Upper profile convex from occiput to dorsal, and keel only a little distinct just before dorsal, also an indistinct keel on each side. Post-dorsal region rounded, with a median and a lateral keel on each side, all indistinct. Same also continued behind adipose dorsal. Post-ventral region with distinct median keel and a rather indistinct keel on each side converging toward anal. Snout convex, both surface and profile, and upper profile of head straight. Rakers small or minute weak filaments (mostly damaged). Origin of dorsal falling in vertical about midway between tip of snout and posterior basal margin of adipose fin. Third simple dorsal ray longest, longer than head, or about  $\frac{1}{2}$  of head and trunk. First branched anal ray apparently longest,  $1\frac{1}{2}$  in head. Pectoral reaching  $\frac{3}{4}$  of space to ventral. Ventral extending  $\frac{5}{8}$  of space to anal. Length (with damaged caudal)  $5\frac{1}{2}$  inches. A single example, most likely from Dr. Hering's collection, and taken in Surinam?, rather than "*Curimatus spec. indet.*" Cope, *Proc. Amer. Philos. Soc. Phila.*, XI, 1869-70 (August 19, 1870), p. 566, from Pebas, Hauxwell Coll.

CYPHOCHARAX subgen. nov.

Type *Curimatus spilurus* Günther.

Back well elevated, or hunched, anteriorly. Scales large, in even longitudinal series which slope a little from head posteriorly.

(*Κυφός*, gibbous or hunched; *χάραξ*, an old name used by Gronow for the typical genus of this family and first introduced by Scopoli.)

*Curimata spilura* (Günther). Fig. 4.

*Curimatus spilurus* Cope, *Proc. Amer. Philos. Soc. Phila.*, XVII, 1877-78 (May 17, 1878), p. 684. Peruvian Amazon. Prof. J. Orton. Coll. of 1873.

Interorbital space  $2\frac{1}{2}$  in head. Predorsal region trenchant, not grooved, and anterior dorsal profile of body steep. Gill-rakers not evident and scales not serrate. The example figured most likely from Nauta. Also three others which do not vary except that the hump, or elevated back, seems to be a little less in height than in the smaller ones. This agrees fairly well with Dr. Günther's account, though the

head would differ as it is said to be  $3\frac{3}{4}$  to 4 in the body without caudal. The pectoral is apparently shorter in my examples.

The closely related forms, *Curimata spiluropsis* (Eigenmann and Eigenmann) and *Curimata dorsale* (Eigenmann and Eigenmann), do not appear to differ markedly. In fact it is not difficult to discover most of the characters assigned to each by Dr. and Mrs. Eigenmann in

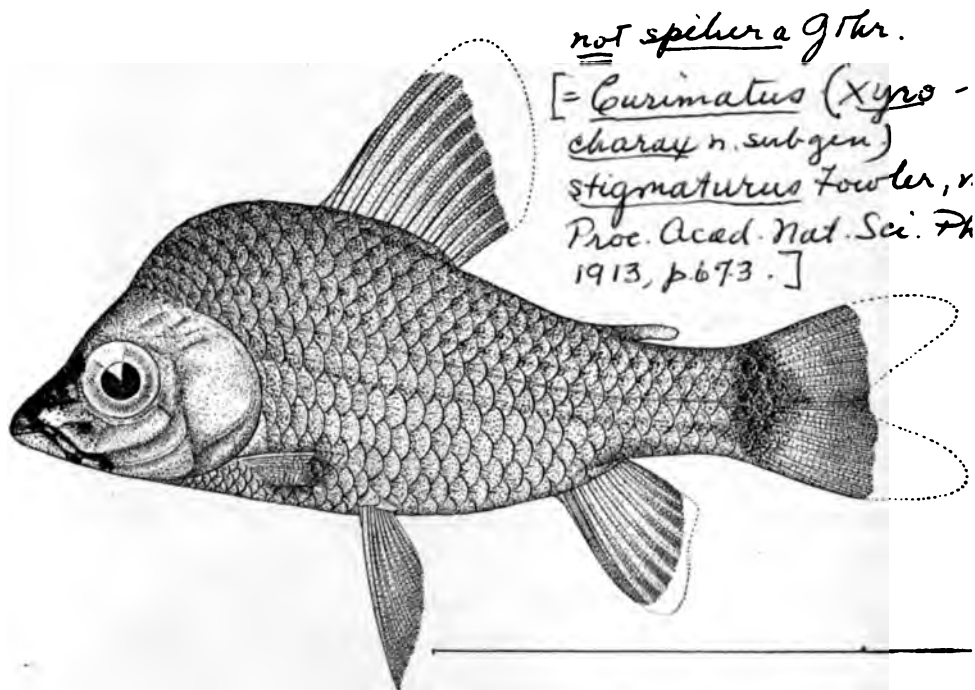


Fig. 4.—*Curimata spilura* (Günther).

the examples before me. Under *Curimatus spilurus* these writers state that the predorsal region is depressed or grooved till near the dorsal fin. This I am unable to determine.

STEINDACHNERINA subgen. nov.

Type *Curimatus trachystethus* Cope.

This group comprises those species of *Curimata* with the postventral region rounded, or with an obtuse median keel, and the back normal or not hunched as in *Cyphocharax*. Scales in most species finely serrate.

(Dedicated to Dr. Franz Steindachner, of the Royal Academy of

Natural Sciences of Vienna, as a slight recognition of his thoroughly excellent contributions to Ichthyology.)

*Curimata trachystethus* (Cope). Fig. 5.

*Curimatus trachystethus* Cope, Proc. Amer. Philos. Soc. Phila., XVII, 1877-78 (May 17, 1878), p. 684. No. 21,470, A. N. S. P., type. Peruvian Amazon, probably from Pebas. Prof. J. Orton. Coll. of 1877.

Width of head  $1\frac{1}{2}$  in its length; width of mouth  $3\frac{1}{2}$ ; interorbital space  $2\frac{1}{2}$ . Body well compressed. Head convexly restricted below and broad above. Snout broad and obtuse in profile when viewed from above. Mouth broad. Jaws and lips thin. Mandibular angle very obtuse and with a little protuberance at symphysis fitting in a depression in front of upper jaw. Tongue a little narrow, median, rather

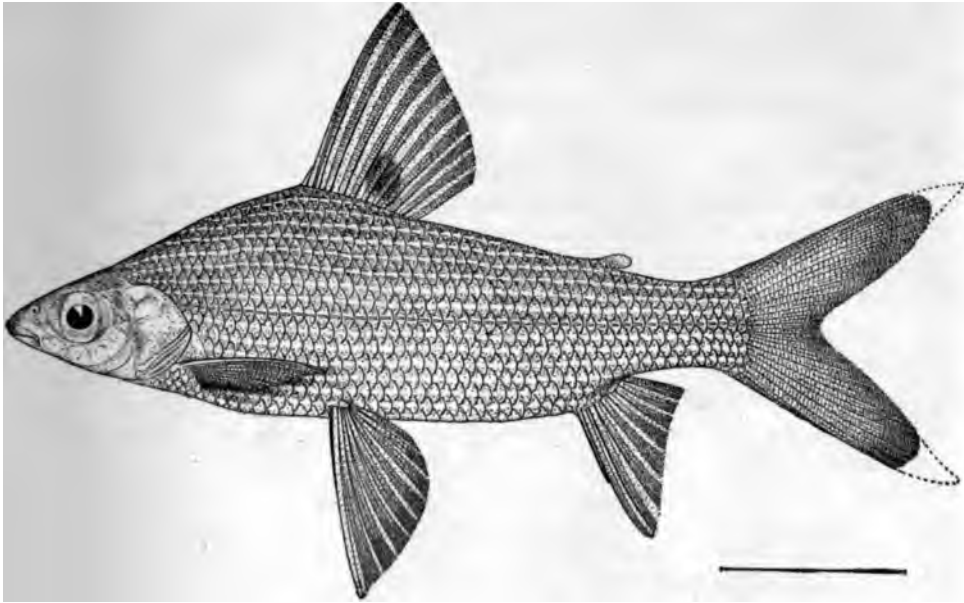


Fig. 5.—*Curimata trachystethus* (Cope).

far back, and little free in front. Interorbital space broadly convex and more or less flattened medianly. Gill-opening large and extending forward till about opposite posterior margin of pupil. No rakers. Filaments a trifle more than half of orbit. Isthmus rather broadly triangular. A short pointed scaly flap in axil of pectoral. Predorsal region with a median rounded keel. Postdorsal region rounded. Pre-ventral region flattened. Postventral region with a median obtuse

keel and a similar one on each side. Color at present in alcohol pale greenish-brown, due most likely to preservative. Back a little darker. Fins all plain, except dorsal, which is marked with a large blackish blotch nearer bases of median rays. Iris deep brown. Length  $4\frac{7}{8}$  inches (caudal damaged).

Cope's statements that "the depth at the front of the dorsal fin is one-third the length of the caudal" and "the length of the head is one-fourth the same" are impossible. He evidently intended to refer to the body.

*Curimata gilberti* Quoy and Gaimard.

*Curimatus gilbertii* Cope, Proc. Amer. Philos. Soc. Phila., XXXIII, 1894 (January 5), p. 93. Many examples from the Brazilian province of Rio Grande do Sul, probably at São João. H. H. Smith Coll.

All have the dark caudal spot evident, and in the larger ones it is very distinct. In some small ones it is preceded laterally and medianly by an irregular series of small blackish spots of uneven size. In others this is connected by a dusky streak, fading out anteriorly and enclosing the lateral line. In fact the species shows considerable color variation. Also a large uniformly colored example from Campos, Brazil. The proportions, etc., of all the examples range as follows: Head 3 to  $3\frac{1}{4}$ ; depth  $2\frac{1}{4}$  to 3; D. III, 9; A. III, 7, 1; scales 33 to 38 in lateral line to base of caudal and 3 or 4 continued on the latter; 6 or 7 scales, usually 6, obliquely back from origin of dorsal to lateral line; 6 scales obliquely between lateral line and origin of ventral; 14 to 16 scales before dorsal; total length of specimens ranging from  $2\frac{1}{4}$  to  $8\frac{1}{8}$  inches.

[1871]

PELTAPLEURA subgen. nov.

Type *Salmo cyprinoides* Linnæus.

Scales on costal region enlarged, much larger than elsewhere on body and converging posteriorly so as to form even series with the others.

(Πέλπη, a small light shield, here used with reference to the scale πλευρά, the side or rib.)

*Curimata cyprinoides* (Linnæus). Fig. 6.

*Curimatus cyprinoides* Cope, Proc. Acad. Nat. Sci. Phila., 1871 (1872) 258. Ambyiacu River, Equador. John Hauxwell.

Of 11 examples 4 before me have the squamation fairly per. They show the scales in the lateral line ranging from 45 to 48.



counted to base of caudal, and 4 or 5 more on the latter. The figure is based on the largest of these.

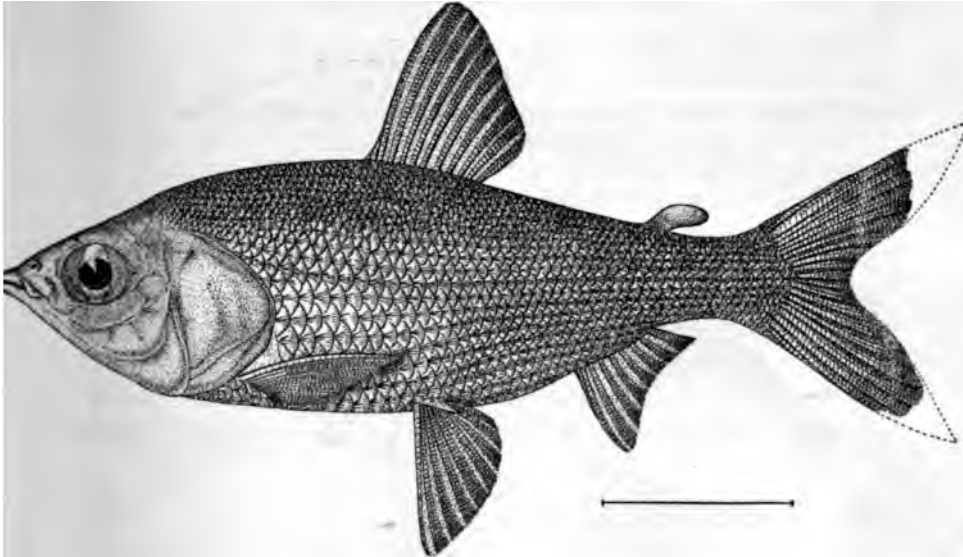


Fig. 6.—*Curimata cyprinoides* (Linnaeus).

Subgenus CURIMATA Cloquet.

Postventral region trenchant. Scales small, 51 to 70 in a lateral count, and forming more or less even longitudinal series.

In view of the uncertainty of identification of *Salmo edentulus* Bloch, which is more like the example I shall identify as *Curimata schomburgkii*, I have allowed this subgenus to fall with it and related species. Further, its identification with *Salmo cyprinoides* Linnaeus may be questioned, and if any credit is attached to Bloch's figure the scales are a little large.

*Curimata copei* sp. nov. Fig. 7.

Head 3; depth  $2\frac{1}{2}$ ; D. III, 9; A. III, 9, 1; P. II, 13; V. II, 9; scales 50? in lateral line to base of caudal (squamation injured), and about 4? more on latter; about 15 scales between origin of dorsal obliquely down to lateral line; about 9 series of scales between lateral line vertically to origin of ventral; about 9 scales in a vertical series between lateral line and origin of anal; about 28 scales before dorsal; width of head  $2\frac{1}{2}$  in its length; depth of head  $2\frac{1}{2}$ ; snout  $3\frac{1}{2}$ ; eye  $3\frac{1}{2}$ ; width of mouth  $3\frac{1}{2}$ ; interorbital space  $2\frac{1}{2}$ ; base of dorsal 2; least depth of caudal peduncle  $2\frac{1}{2}$ ; base of anal 2; ventral (damaged)  $1\frac{1}{2}$ .

Body well compressed, greatest depth at origin of dorsal, and back well elevated. Upper anterior profile gibbous or convex. Edge of back rounded. Caudal peduncle compressed, its length about  $\frac{1}{2}$  in least depth.

Head rather constricted below, upper surface convex and with a nearly straight profile to occiput. Nuchal region convex. Head of rather even width. Snout broad and obtuse, especially when viewed

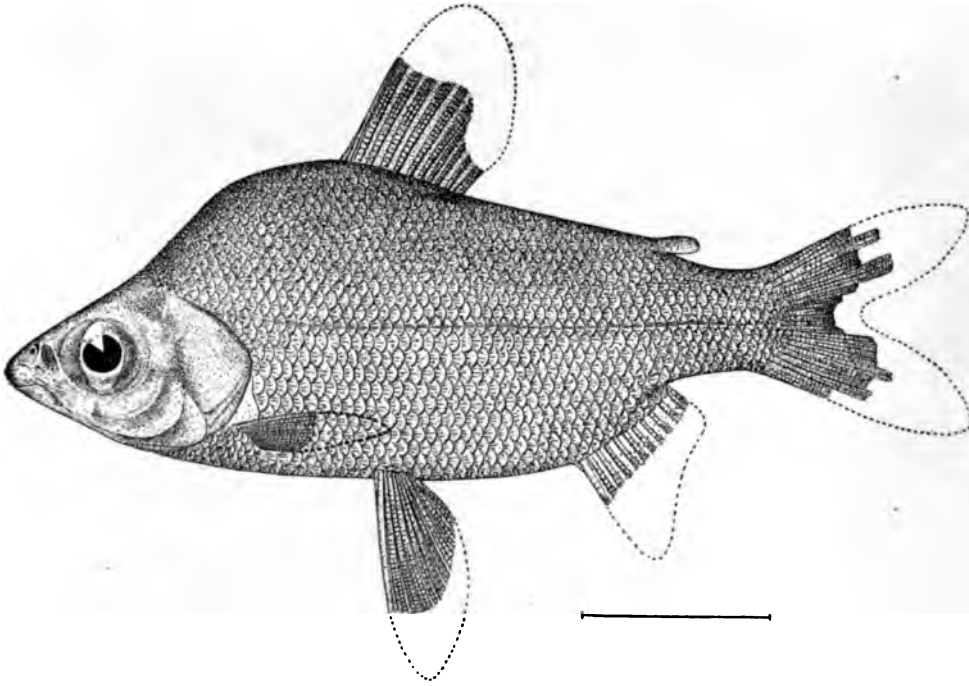


Fig. 7.—*Curimata copei* Fowler.

from above, and a little produced beyond tip of mandible. Eye large, its center near first  $\frac{1}{3}$  in length of head, and a trifle longer than deep. Adipose eyelids a little broad. Mouth broad, a little inferior, and symphysis with a little knob fitting in a depression in upper jaw. Mandibular angle broadly obtuse. Tongue thick, rounded, hardly free in front, and not broad. Nostrils adjoining, superior, a little nearer front of eye than tip of snout and posterior larger. Anterior nostril circular, and with a cutaneous margin. Interorbital space broad, a little elevated, and flattened medianly. Postorbital about equal to preorbital or about size of pupil. First infraorbital a little

more than half length of second which is long. Preopercle with several distinct flutings. Gill-flap rather narrow. Opercle smooth.

Gill-opening extending forward not quite opposite to posterior margin of pupil. Upper cleft of gill-opening extending forward a little more than at a point equal to last  $\frac{2}{3}$  in length of head. About  $15 + 28?$  small short rudimentary filamentous-like rakers on first arch. Gill-filaments long, longest about 2 in horizontal orbital diameter. Isthmus nearly forming an equilateral triangle.

Scales moderately small, adherent, and forming longitudinal series parallel with lateral line. Scales below lateral line, or those on breast and abdominal region, a little larger than others. Scales passing over ventral carina. No narrow median naked strip from occiput to dorsal, scales passing over. Head naked. Scales on chest a little smaller than those on breast. No scales on dorsals, pectorals and ventrals. Base of caudal with scales, and along basal region of anal. Base of ventral inside with a broad flat scaly flap, and another flap, but narrow and at present equal to about  $\frac{1}{2}$  of fin (damaged), placed in axil. No flap in pectoral axilla. Lateral line of simple tubes, continuous, slightly decurved at first and then straight to caudal.

Dorsal inserted about midway in vertical between tip of snout and posterior basal margin of adipose fin. Dorsal high, first branched rays evidently highest and others graduated down. Adipose fin well developed and its base about last  $\frac{2}{3}$  in space between dorsal and base of caudal. Anal evidently low and its origin a little nearer base of caudal, in vertical, than origin of ventral. Caudal emarginate (damaged), and rays well branched. Pectoral small and low. Ventral inserted about opposite base of second branched dorsal ray, and reaching about  $\frac{2}{3}$  of distance to anal (damaged). Vent close in front of anal.

Color in alcohol brassy-brown, back with a dull olivaceous tinge. Fins all brownish. Iris deep brown.

Length  $4\frac{1}{2}$  inches.

Type, No. 8,201, A. N. S. P. Surinam. Smithsonian Institution.

One example, the type. This was long ago considered a new species by Cope. It appears to be closely related to *Curimata schomburgkii* (Günther), but differs at once in the deep body, the upper profile of which is more gibbous anteriorly.

(Named for Prof. Edward D. Cope.)

*Curimata schomburgkii* (Günther). Fig. 8.

Body well compressed. Edge of back rounded. Caudal peduncle compressed. Head compressed, a little constricted inferiorly, upper surface convex. Nuchal region also convex. Head of rather even

width. Snout broad, blunt when viewed above. Mouth broad and symphysis with a knob fitting in a cavity of upper jaw. Mandibular angle broadly obtuse. Tongue small, as usual rather far back, flattened, a little thick and only edges free. Interorbital space broad and a little

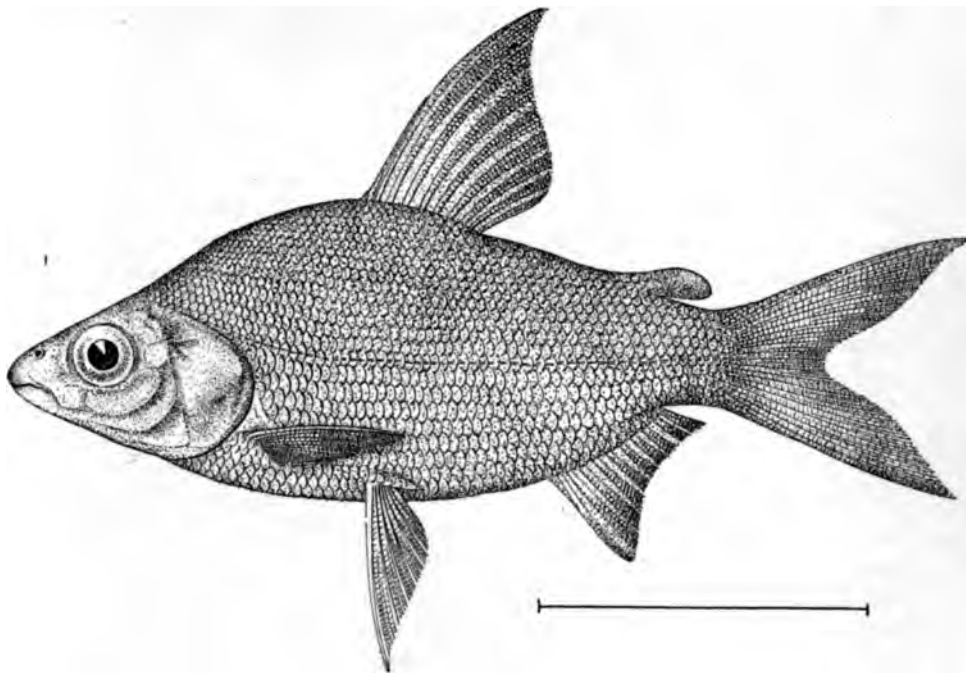


Fig. 8.—*Curimata schomburgkii* (Günther).

elevated convexly, not especially flattened medianly. Gill-opening forward till not quite opposite posterior margin of pupil. Upper cleft of gill-opening extending forward  $\frac{2}{3}$  in length of head. Gill-rakers  $10? + 32?$ , small short rudimentary-like weak filaments. Gill-filaments about 2 in eye. Isthmus a little broad and triangular. Scales more or less adherent, passing over ventral keel and ridge before dorsal. Scales on chest a little smaller than those on breast. Base of ventral inside with a broad scaly flap. Vent close to anal. Color in alcohol brassy-brown. Length  $4\frac{1}{2}$  inches (caudal damaged).

Two examples from Surinam, larger described above. Dr. Hering. The smaller example is in better preservation. It shows: Head  $2\frac{1}{2}$ ; depth  $2\frac{1}{2}$ ; D. III, 8; A. III, 9, 1; scales 54 in lateral line to base of caudal, and 4 more on latter; snout  $3\frac{1}{2}$  in head; eye  $3\frac{1}{2}$ ; pectoral  $1\frac{1}{2}$ ; ventral

1 $\frac{1}{2}$ ; upper caudal lobe about 1. Rakers distinct. First branched ray of dorsal longest, and reaching well beyond others, when fin is depressed, or to origin of adipose fin. Adipose fin long, its length along posterior margin but little less than length of its base. Anterior anal rays elevated. Caudal long, deeply forked, and each lobe well pointed. Pectoral long, pointed, and reaching origin of ventral. Ventral long and pointed, and reaching origin of anal.

**Semitaplois laticeps** (Valenciennes).

*Curimatus allamazonicus* Cope, Proc. Amer. Philos. Soc. Phila., XVII, 1877-78 (May 17, 1878), p. 684. Nos. 21,118 (type) to 21,120, A. N. S. P., cotypes. Peruvian Amazon. Prof. J. Orton. Coll. of 1873.

Head 3 $\frac{1}{2}$ ; depth 2 $\frac{1}{2}$ ; D. II, 9, 1; A. III, 12, 1; P. I, 16; V. II, 8; scales about 88 in lateral line to base of caudal (squamation injured), and 6 more on latter; width of head 2 $\frac{1}{2}$  in its length; depth of head 1 $\frac{1}{2}$ ; snout 3 $\frac{1}{2}$ ; width of mouth 3 $\frac{1}{2}$ ; interorbital space 2 $\frac{1}{2}$ ; base of dorsal 2 $\frac{1}{10}$ ; base of anal 2; least depth of caudal peduncle 3; pectoral (damaged) 2; ventral (damaged) 1 $\frac{1}{2}$ . No gill-rakers, and filaments 1 $\frac{1}{2}$  in eye. Color in alcohol brown, paler on lower surface or below lateral line. Head dark on top, like back, and sides and under portions pale. Fins all brownish. Eye dusky. Length (caudal damaged) 7 $\frac{1}{4}$  inches. Type.

The other cotypes show: Head 3 and 3 $\frac{1}{10}$ ; depth 2 $\frac{3}{8}$ ; D. II, 10, 1; A. II, 13, 1; total length of body 6 $\frac{1}{2}$  and 7 $\frac{1}{8}$  inches respectively (caudals damaged).

**Psectrogaster oiliatus** (Müller and Troschel).

*Curimatus rutiloides* Cope, Proc. Acad. Nat. Sci. Phila., 1871 (1872), p. 258. Ambyiaçu River, Equador. John Hauxwell. (Not of Kner.)  
*Curimatus cyprinoides* Cope, l.c., p. 291. Between the mouth of the Rio Negro and the Peruvian Amazon or Ucayale River. Robert Perkins. (Not of Linnaeus.)

Head 3; depth 2 $\frac{1}{2}$ ; D. III, 9, 1; A. III, 7, 1; scales 48 in lateral line to base of caudal, and 5 more on latter; 12 scales in an oblique series back from origin of dorsal to lateral line; 9 series of scales obliquely back from origin of ventral to lateral line; 9 series of scales obliquely forward from origin of ventral to lateral line; about 32 scales before dorsal; snout 3 $\frac{1}{2}$  in head; eye 3 $\frac{1}{2}$ ; width of mouth 3 $\frac{1}{2}$ ; interorbital space 2 $\frac{1}{2}$ ; pectoral 1 $\frac{1}{2}$ ; ventral 1 $\frac{1}{2}$ ; least depth of caudal peduncle 2 $\frac{1}{2}$ . Rakers none. Gill-filaments about  $\frac{1}{2}$  of orbit. Postventral carina well developed, scales strongly pectinate which form it. Scales on body all more or less etenoid. Upper and lower profiles of body more or less evenly convex. Scales on trunk enlarged anteriorly on middle of side, so that longitudinal series are formed which are more or less parallel with course of lateral line above, and below converging as they

approach caudal. In alcohol brassy-brown with more or less silvery. Back till about level with occiput a dull olive-brown. Upper surface of head brownish. Body mostly washed with silvery. Fins plain brown, and pale like side. Iris brown. Length  $5\frac{1}{4}$  inches. This is the largest example. It is from between the mouth of the Rio Negro and the Peruvian Amazon. Robert Perkins. Also another example with same data. These are labelled, evidently in Cope's handwriting, as "*Curimatus cyprinoides v. aff.*"

Besides the above are 5 examples from the Ambyiacu river in the Hauxwell collection. Cope's label reads "*Curimatus rutiloides.*" An examination of the air-vessels of two of these examples shows that it persists nearly as far posteriorly till opposite base of penultimate anal ray. It is thus apparent that Cope may have intended all the examples before me to represent his *C. rutiloides*, but the original labels in his own handwriting would lead to the above allocating of the references. The form called *Psectrogaster amazonica* by Dr. and Mrs. Eigenmann I cannot distinguish in my examples.

**Potamorhina pristigaster** (Steindachner).

Cope, Proc. Amer. Philos. Soc. Phila., XVII, 1877-78 (May 17, 1878), p. 685. Peruvian Amazon, probably from Nauta. Prof. J. Orton. Coll. of 1873.

Head 3; depth 2 to  $2\frac{1}{4}$ , a little larger in smaller specimen; D. III, 9; A. III, 11 to III, 13, 1; ventral scutes 22 to 28; scales (squamation damaged) about 90 in lateral line to base of caudal and several more on latter; snout  $3\frac{1}{2}$  to  $3\frac{3}{4}$  in head; eye  $4\frac{1}{2}$  to  $4\frac{1}{4}$ ; width of mouth  $3\frac{1}{2}$  to  $3\frac{3}{4}$ ; interorbital space  $2\frac{1}{2}$  to  $2\frac{3}{4}$ ; total length of 3 examples 6 to 9 inches (caudal damaged).

**Anodus elongatus** Agassiz. Fig. 9.

*Anodus steatops* Cope, Proc. Amer. Philos. Soc. Phila., XVII, 1877-78 (May 17, 1878), p. 683. Nos. 21,498 (type) and 21,499, A. N. S. P., cotypes. Pebas. Prof. J. Orton. Coll. of 1877.

Body rather plump. Head broadly convex above, a little restricted below. Snout when viewed above rather rounded. Edges of jaws not sharp. Lips thin. Rami of mandible well elevated inside mouth. Tongue large, elongate, flattened above, rounded in front and free. Inside mouth upper membrane broad. Interorbital space broadly convex. Gill-opening extending forward to front margin of orbit. Rakers  $66? + 100?$ , long, slender, or very fine and numerous and longest equal to  $1\frac{1}{4}$  eye-diameters. On inner edge of first branchial arch also a series shorter in length. Longest filaments nearly equal orbit. Isthmus long, narrow and slender. A triangular naked space extending back on occiput. Edges of body rounded except those of lateral

line. Vent close in front of anal. Color in alcohol dull olive-brown, darker on back, and top of head deep brownish. Fins dull greenish, bases of caudal lobes blackish. A brownish or dusky blotch on several scales about and in lateral line about opposite tip of depressed dorsal. Greenish tints all probably due to the preservative. Iris and adipose eyelid brownish. Length (caudal damaged)  $10\frac{1}{2}$  inches. Type.

In explanation of Cope's remarks it may be stated that these fishes

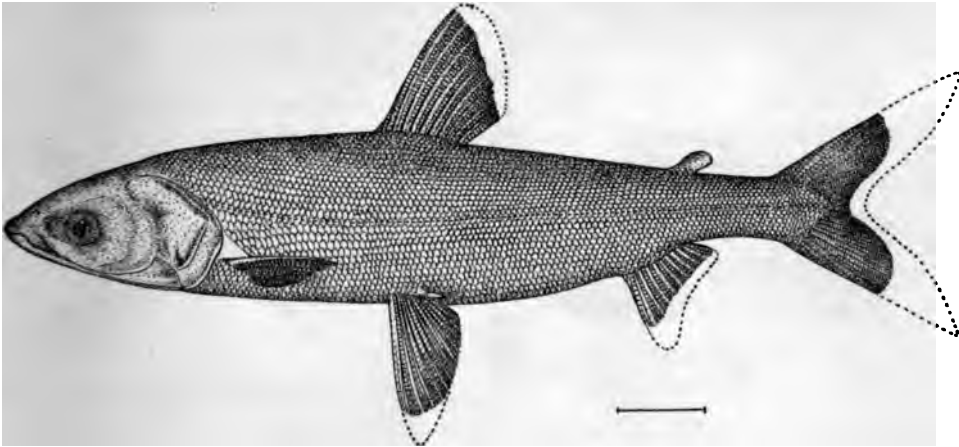


Fig. 9.—*Anodus elongatus* Agassiz.

agree best with *Anodus elongatus* Agassiz, a species from which I am unable to separate it. The pectorals and ventrals, although damaged, reach more than half the distance credited. The ventrals are more anterior in position, or originate under the anterior portion of the dorsal, and not opposite its middle.

**EIGENMANNINA** gen. nov.

Type *Anodus melanopogon* Cope.

Head large, especially opercular apparatus, and upper profile strongly concave. Mandible well produced beyond tip of upper jaw so that mouth is superior. Eye above middle in depth of head. Body heavy anteriorly, and tapering towards caudal. In other respects more or less allied to *Anodus*.

(Named for Dr. Carl H. Eigenmann, of the Chair of Zoology in Indiana University, a well-known authority on South American fishes.)

*Eigenmannina melanopogon* (Cope). Fig. 10.

*Anodus melanopogon* Cope, Proc. Amer. Philos. Soc. Phila., XVII, 1877-78 (May 17, 1878), p. 682. Nos. 21,227 (type) to 21,232, A. N. S. P., cotypes. Peruvian Amazon. Prof. J. Orton. Coll. of 1873.

Width of head  $3\frac{1}{2}$  in its length; interorbital space  $4\frac{1}{2}$ . Body, head and caudal peduncle compressed. Upper surface of head narrow, convex, and lower surface constricted. Snout rounded and convex when seen from above. Jaws more or less flattened or spatulate. Each ramus of mandible well elevated inside of mouth. Lips hardly developed or very thin. Tongue small, narrow, rather thick, fleshy,

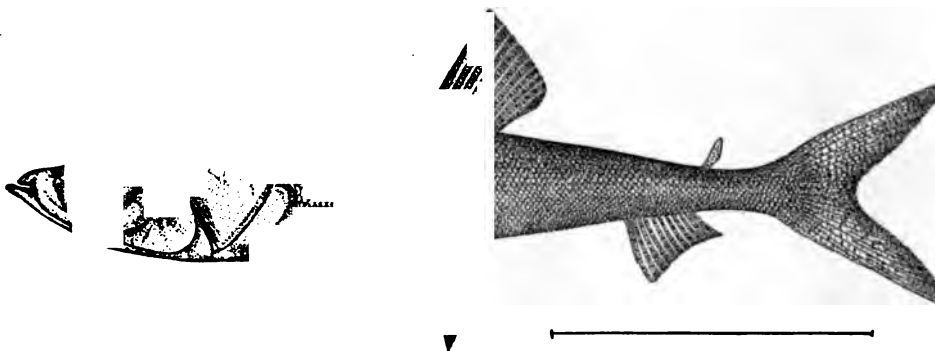


Fig. 10.—*Eigenmannina melanopogon* (Cope).

and united with floor of mouth by a median fleshy frenum. Upper buccal membrane rather narrow. Interorbital space a little elevated convexly and flattened medianly. Gill-opening large, extending forward till a little before front rim of orbit. Vent close in front of anal. Color in alcohol more or less silvery, back brown fading to white on sides and under surface. Top of head brown, sides and lower surface silvered white. Fins pale brownish, dorsal and caudal a trifle darker, and each ray of most fins speckled or spotted rather indistinctly with darker brownish. Iris rather brassy. Length  $2\frac{1}{2}$  inches (caudal damaged). Type.

One example shows  $35? + 54?$  slender rakers, and longest about equals eye or much longer than filaments.

With reference to the original description, Cope evidently intended to state that the base of the first dorsal ray was three millimeters nearer the end of the muzzle than the base of the caudal. Both pectorals and ventrals reach more than half way in the spaces stated. Cope evidently counts 128 rows of scales from the occipital region, and those on base of caudal. The origin of the ventral is below the bases of



the anterior dorsal rays. Most of rays of the fins are specked with brownish.

This species is related to *Eigenmannina orinocensis* (Steindachner), but differs in the fewer scales, absence of the dark median lateral blotch and the coloration of the caudal.

CHILOMYZON subgen. nov.

Type *Prochilodus steindachneri* sp. nov.

Scales large, less than 40, usually between 33 and 38 in a lateral count. Mouth disk-like and inferior. Related to *Prochilodus* Agassiz. (*Χείλος*, lip; *μύζω*, to suck.)

*Prochilodus steindachneri* sp. nov. Fig. 11.

Head  $3\frac{1}{2}$ ; depth  $2\frac{1}{2}$ ; D. III, 9, 1; A. III, 8, 1; P. I, 14; V. I, 8; scales 34 in lateral line to base of caudal and 3 more on latter; about 14 scales

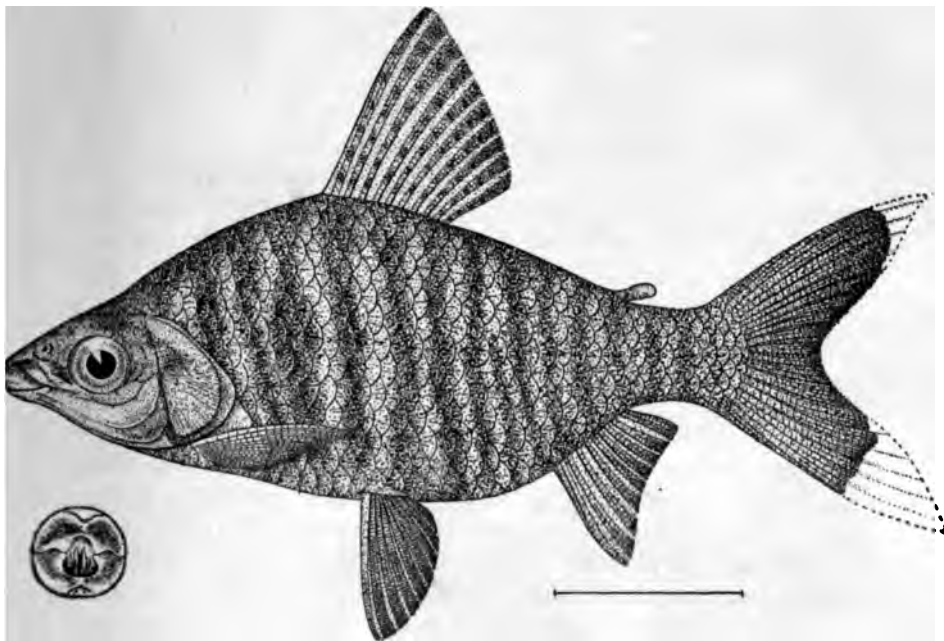


Fig. 11.—*Prochilodus steindachneri* Fowler.

before dorsal; 7 scales obliquely back from origin of dorsal to lateral line; 6 scales obliquely forward from origin of ventral to lateral line, and same number in similar count from origin of anal; about 16 scales from isthmus to origin of ventral; 3 scales obliquely back from origin

of adipose fin to lateral line; width of head  $1\frac{1}{2}$  in its length; depth of head  $1\frac{1}{2}$ ; snout  $3\frac{1}{2}$ ; eye  $3\frac{1}{2}$ ; width of mouth  $2\frac{1}{2}$ ; interorbital space  $2\frac{1}{2}$ ; third dorsal ray  $1\frac{1}{2}$ ; third anal ray 2; length of pectoral  $1\frac{1}{2}$ ; of ventral  $1\frac{1}{2}$ ; least depth of caudal peduncle  $2\frac{1}{2}$ .

Body deep, compressed, rhomboid in shape, and suggesting certain *Cyprinidae*. Upper profile more or less evenly convex, back elevated, and greatest depth at origin of dorsal. Lower profile at first straight for a good distance, and becoming convex posteriorly. Caudal peduncle compressed, short, and its least depth about equals its length.

Head small, compressed or restricted a little below, and upper surface broadly rounded. Lower surface of head also flattened. Snout broad, obtuse, fleshy, and produced well beyond tip of mandible. Eye circular, a trifle anterior, and above center in depth of head. Eyelid narrow. Mouth broad, and in profile of gape curved downwards. When opened mouth is broad, directed inferiorly, and jaws furnished with broad thick and fleshy lips formed somewhat as a disk. Margin of this disk with a single series of small weak or movable ciliiform teeth. In front of each jaw behind outer series a short second or inner series of similar ones, convex or angular in its course, and with bend or angle directed inwards. Aperture of mouth small. Tongue small, hardly free from floor of mouth. Nostrils close together on side of snout above, and much nearer upper front rim of orbit than tip of upper jaw. Anterior nostril circular, with its posterior cutaneous margin more or less concealing posterior which is thus lunate. Interorbital space broad and convex. Infraorbital rim narrow, lowest or most posterior largest. Preorbital a little swollen, with a deep cavity and large thick lip and maxillary more or less filling it when mouth is closed. Opercle striate. Opercular flap broad and rather cutaneous.

Gill-opening extending forward till nearly opposite posterior margin of orbit. Rakers none. Filaments of inner series a little longer than those in outer, or about equal to  $\frac{1}{4}$  of orbital diameter. Isthmus broad. Branchiostegals long, broad, subequal, and 4 on each arch.

Scales large, of more or less even size, disposed in longitudinal series parallel with lateral line, and each one with several striæ. Margin of each scale also a little rough. Small scales on bases of caudal and anal, otherwise fins and head naked. A pointed scaly flap in axil of ventral equal to about  $\frac{1}{3}$  of length of ventral. Both predorsal and postdorsal regions with a median keel, former most distinct, and latter also extending on upper surface of caudal peduncle behind adipose fin though still less distinct. Behind first dorsal also an indistinct lateral keel on each side, and below and posterior to adipose fin they are also

evident. Preventral region keeled in similar manner to postdorsal, only median keel most pronounced. Postventral and postanal region keeled, former may be considered almost trenchant. Lateral line continuous, of simple tubes, a little above middle in depth of body and continuous to caudal.

Dorsal high, third ray longest, and origin of fin would fall in vertical about midway between tip of snout and base of adipose fin. Anal small, anterior rays longest, margin of fin concave, and its origin nearer base of caudal than origin of ventral. Adipose dorsal small, its base inserted about opposite bases of last anal rays. Caudal long, deeply emarginate and end of each lobe apparently more or less pointed. Pectoral rather long, pointed, and extending beyond origin of dorsal or about  $\frac{3}{4}$  of space to ventral. Ventral inserted nearly opposite middle of base of dorsal or about midway between origin of anal and that of pectoral, and extending about  $\frac{3}{4}$  of distance to former. Vent close in front of anal fin.

Color in alcohol more or less pale brownish washed with silvery-purplish. Back a little darker than side and lower surface. Body also with about fifteen or more indistinct vertical or transverse purplish-dusky bands. Dorsal with about six series of brownish spots on rays. Other fins pale plain brownish. Iris brassy.

Length 5 inches.

Type, No. 8,207, A. N. S. P. Parahyba, Brazil. Museum of Comparative Zoology, Cambridge, Mass. Only one example, the type.

This species is closely related to *Prochilodus corimbata* (Kner) = *Salmo corimbata* Natterer, in Kner = *P. nigricans* Kner, nec Agassiz = *P. oligolepis* Günther. Dr. Steindachner's account of the last does not give the coloration. Other related species are *P. humeralis* Günther and *P. vimboides* Kner, both differing in proportions, etc.

(Named for Dr. Franz Steindachner.)

Subgenus *PROCHILODUS* Agassiz.

Scales small, more than 40 or usually between 40 and 60 in a lateral count. Mouth similar to that of *Chilomyzon*.

*Prochilodus ortonianus* Cope. Fig. 12.

Proc. Amer. Philos. Soc. Phila., XVII, 1877-78 (May 17, 1878), p. 685. No. 21,267 (type), A. N. S. P., cotype. Nauta, Peru. Prof. J. Orton. Coll. of 1873.

Width of head  $1\frac{3}{4}$  in its length; width of mouth  $2\frac{3}{4}$ ; interorbital space 2. Body robust, compressed, and caudal peduncle similar. Head broad, robust, convex on upper surface, and lower surface but little restricted

though more evenly convex. Width of head more or less even. Snout broad, convex above and broadly rounded when viewed from above. Interorbital space convex and median narrow fontanel extending from internasal space to occiput. Head with arborescent mucous canals on upper side posteriorly and on suborbital region. Gill-opening falling a trifle short of posterior margin of orbit. Rakers none. Gill-filaments about  $1\frac{1}{2}$  in eye. Isthmus broad. Branchiostegals 4, large, well developed and subequal. Scales a little rough and each one

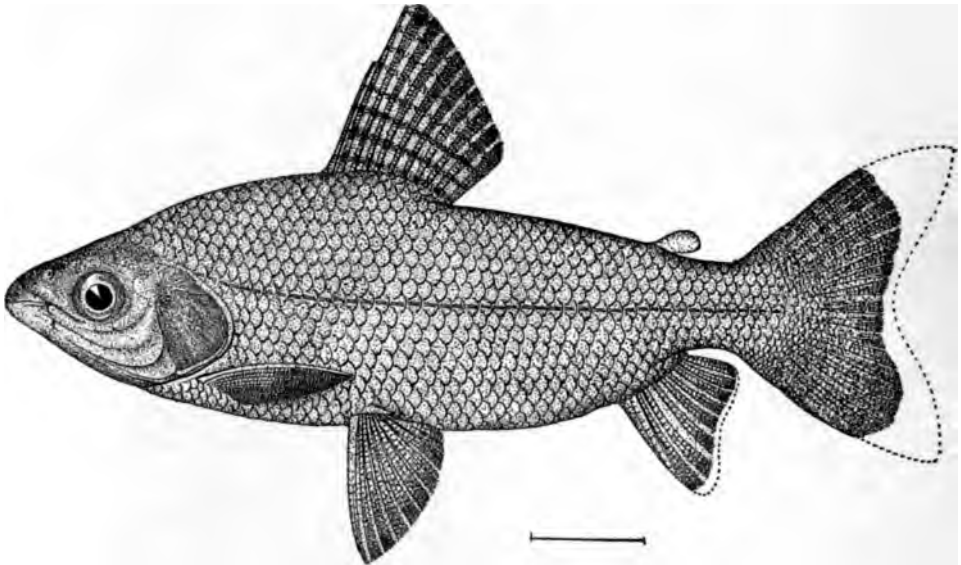


Fig. 12.—*Prochilodus ortonianus* Cope.

with several striæ. Predorsal region slightly keeled. Postdorsal region rounded. Upper and lower surfaces of caudal peduncle a little flattened. Preventral region flattened medianly. Postventral region sharply keeled medianly and an obsolete keel on each side, all three converging towards vent. Color in alcohol at present dull olivaceous or brassy-brown, back with more or less dull metallic shades. Fins all pale brownish, dorsal and caudal each with about 8 series of brownish spots on each ray of former, and about 6 on each lobe of caudal, so that on latter they form more or less transverse bands. Iris brownish. Length  $7\frac{3}{4}$  inches. Type.

*Prochilodus ocephalotes* Cope. Fig. 13.

Proc. Amer. Philos. Soc. Phila., XVII, 1877-78 (May 17, 1878), p. 686. No. 21,211, A. N. S. P., type. Peruvian Amazon. Prof. J. Orton. Coll. of 1873.

Width of head  $1\frac{1}{2}$  in its length; width of mouth  $2\frac{1}{4}$ ; interorbital space

2. Width of head greatest in postero-supraocular region. Gill-filaments about  $\frac{3}{4}$  of orbit. Predorsal region apparently keeled. Pre-ventral region apparently rounded, and postventral region keeled. Color in alcohol more or less pale plumbeous and somewhat silvered. Back darker or dusky-plumbeous. Upper surface of head like back,

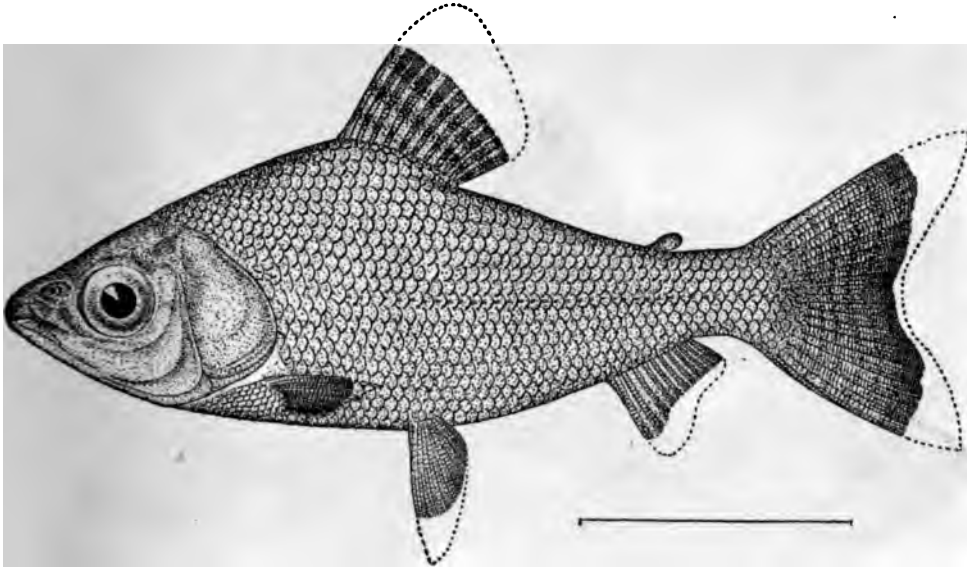


Fig. 13.—*Prochilodus cephalotes* Cope.

and lower surface like that of belly. Damaged dorsal with at least 4 series of deep brownish spots on rays. Caudal also with transverse series of spots, other fins plain. Iris brassy. Length  $2\frac{3}{4}$  inches. Otherwise like the preceding.

*Prochilodus theraponura* sp. nov. Fig. 14.

*Prochilodus insignis* Cope, Proc. Acad. Nat. Sci. Phila., 1871 (January 16, 1872), p. 258. Ambyiacu River, Equador. John Hauxwell.

Head  $2\frac{1}{2}$ ; depth  $2\frac{1}{2}$ ; D. III, 9; A. III, 8, 1; P. II, 11?; V. II, 8; scales about 40? (squamation damaged), and 5? more evidently on base of caudal; about 10? scales obliquely back from origin of dorsal to lateral line; about 8? scales obliquely forward from origin of anal to lateral line; 14 scales before dorsal; width of head about 2 in its length; depth of head  $1\frac{1}{2}$ ; snout  $3\frac{1}{2}$ ; eye 3; width of mouth 3; interorbital space  $2\frac{1}{2}$ ; length of first branched dorsal ray  $1\frac{1}{2}$ ; base of dorsal  $2\frac{1}{10}$ ; base of anal  $2\frac{1}{2}$ ; length of upper caudal lobe 1; pectoral  $1\frac{1}{2}$ ; ventral  $1\frac{1}{2}$ ; least depth of caudal peduncle  $3\frac{1}{2}$ .

Body robust, compressed, back but little elevated so that upper profile would form an obtuse angle at origin of dorsal, and lower profile more or less evenly convex. Greatest depth at origin of dorsal. Caudal peduncle compressed, and its length about  $\frac{2}{3}$  its least depth.

Head compressed, convex on upper surface, and sides constricted below. Greatest width in postero-supraocular region, and upper profile nearly straight or only a trifle concave. Snout short, convex, rather broad, and rounded when viewed from above. Eye circular,

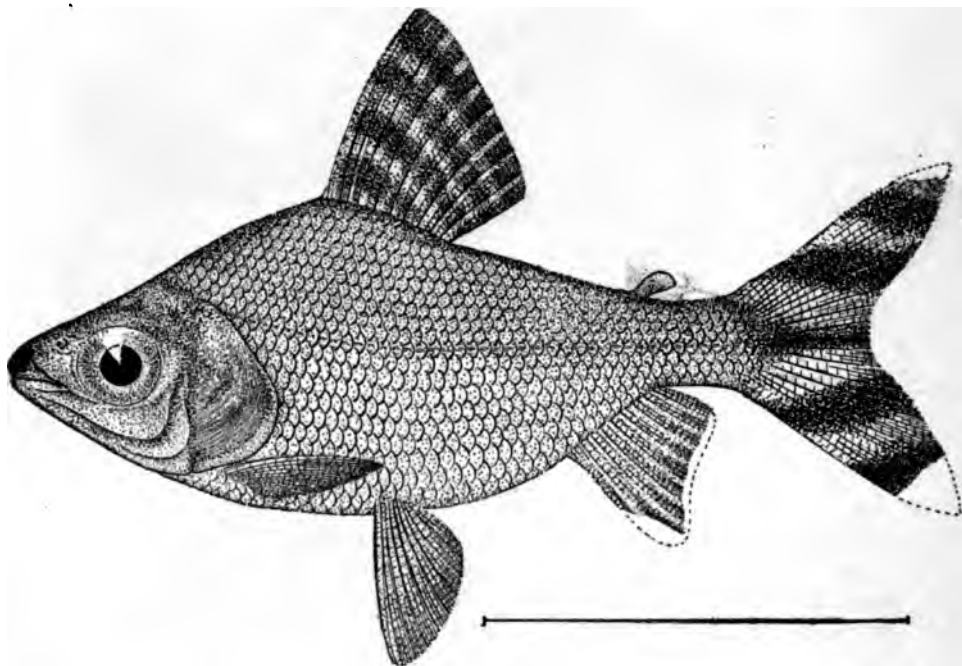


Fig. 14.—*Prochilodus theraponura* Fowler.

anterior, and a trifle above middle of depth. Eyelid narrow. Jaws even, a little broad, and together with mouth and nostrils like in preceding species of *Prochilodus*. Interorbital space convex, and median fontanel extending from internasal region to occiput, broader. Post-orbital largest in suborbital rim. Mucous channels on cranium laterally not pronounced. Opercle with indistinct curved transverse striæ. Gill-flap apparently narrow.

Gill-opening extending forward a little in advance of posterior margin of orbit. Rakers none. Gill-filaments equal, about  $\frac{2}{3}$  length of orbit.

Isthmus a little narrowly compressed. Branchiostegals 4, large and subequal.

Scales mostly fallen, little rough, apparently disposed in even longitudinal series parallel with lateral line, each one with one or more striæ, and apparently of more or less even size. Small scales apparently along bases of dorsal and anal, and on that of caudal. No trace of ventral flap remains. Predorsal region keeled. Postdorsal region rounded. Upper and lower surfaces of caudal peduncle, preventral and postventral regions keeled. Lateral line (damaged) continuous, on base of caudal, nearly straight, more or less median, and of simple tubes.

Origin of dorsal about midway between tip of snout and base of adipose fin, first branched ray longest, and others apparently graduated down. Adipose fin with base over those of last anal rays. Origin of anal much nearer base of caudal than origin of ventral, or nearly midway between base of last dorsal ray and that of caudal, and anterior rays apparently longest. Pectoral low, rather long, and reaching ventral. Ventral with origin a trifle in advance of middle of base of dorsal, and reaching nearly  $\frac{3}{4}$  of space to anal. Vent close in front of anal.

Color in alcohol pale plumbeous, sides and lower surface more or less silvered, and back dusky-plumbeous. Upper surface of head dusky-plumbeous, sides and lower surface silvered. Fins all pale brownish. Dorsal with four well-defined broad deep brown cross-bands. Caudal with two similar colored oblique bands on each lobe, and a median or horizontal one from base of fin to tips of middle rays. Anal with lower anterior tip of fin brownish, and another horizontal transverse band from origin of fin to tips of more posterior rays also of brownish. Pectoral and ventral apparently plain pale brownish. Iris dull brownish.

Length  $2\frac{1}{4}$  inches.

Type, No. 8,033, A. N. S. P. Ambyiacu River, Equador. John Hauxwell. Only one example.

Formerly identified by Cope with *Prochilodus insignis* Kner, this species may at least provisionally be regarded as distinct. This is in view of the identity of *Prochilodus insignis* Jardine and *P. insignis* of Kner, and later of Dr. Günther, not yet having been proved. Schomburgk's figure, as presented by Jardine, shows each lobe of the caudal with five oblique bands besides the median one, which is also in agreement in the description. Dr. Günther's Amazon examples are said to have only three or four bands across each lobe besides the median one.

*Prochilodus theraponura* may thus be said to differ from all of the others in the fact that it has but two oblique dark bars on the caudal, aside from the median one.

(*Θεράπων*, servant, with reference to the caudal bands, like those of *Therapon*; *οὐρα*, tail.)

*Prochilodus amazonensis* sp. nov. Fig. 15.

Head  $3\frac{1}{2}$ ; depth  $2\frac{2}{7}$ ; D. III, 9, 1; A. III, 8, 1; P. I, 16; V. I, 8; scales about 43 in lateral line to base of caudal, and 5 more on latter; 11 scales obliquely back from origin of dorsal to lateral line; 8 scales obliquely forward up from origin of anal to lateral line; 10 scales obliquely up from origin of ventral to lateral line; 15 scales before dorsal; width of head  $1\frac{3}{4}$  in its length; depth of head  $1\frac{1}{2}$ ; snout 3; eye  $3\frac{1}{4}$ ; maxillary  $3\frac{1}{10}$ ;

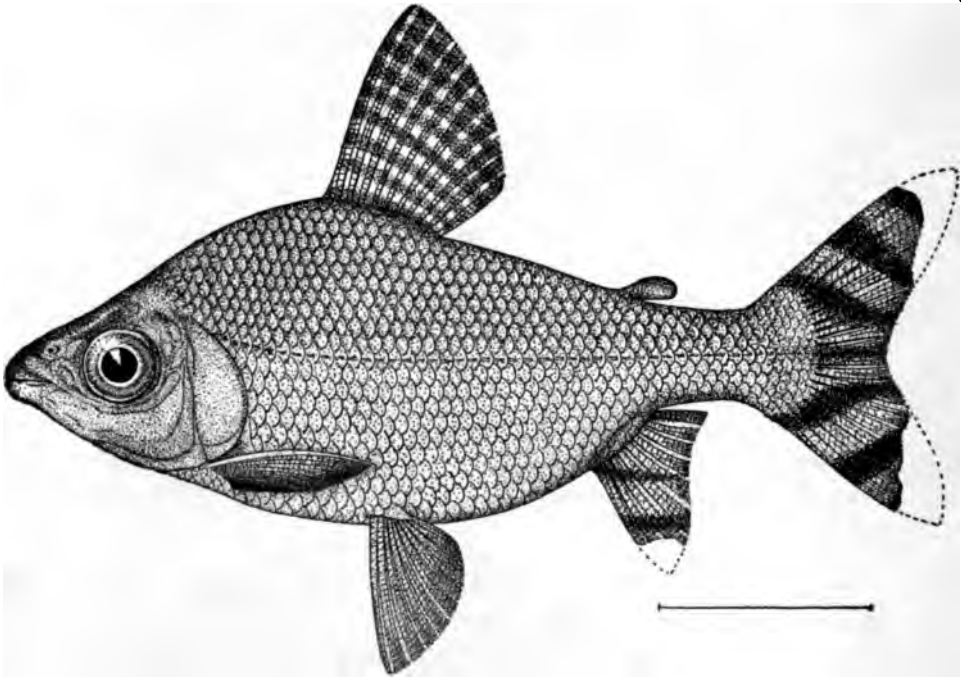


Fig. 15.—*Prochilodus amazonensis* Fowler.

width of mouth  $2\frac{5}{7}$ ; interorbital space 2; length of base of dorsal  $1\frac{1}{4}$ ; length of base of anal  $2\frac{4}{7}$ ; length of pectoral  $1\frac{5}{7}$ ; ventral (damaged)  $1\frac{1}{2}$ ; least depth of caudal peduncle  $2\frac{1}{4}$ .

Body rather deep, compressed, back but little elevated so that upper profile would form a rather obtuse angle at origin of dorsal, at which



point is also greatest depth. Lower profile more or less evenly convex. Caudal peduncle compressed, and its length equals about  $\frac{1}{2}$  its least depth.

Head robust, broad and convex on upper surface with profile nearly straight or only very slightly concave, and lower surface but little restricted, though more evenly convex. Width of head more or less even. Snout broad, rather short, convex above, and broadly rounded when seen from above. Eye circular, anterior, and a little above middle in depth of head. Eyelid narrow. Jaws broad, rounded, almost even or upper a trifle produced. Lips thick and fleshy, and teeth as in preceding species. Upper buccal flap broad and with a median fleshy tubercle in front. Lower buccal flap broad. Tongue and nostrils as in preceding species. Interorbital space also similar, and fontanel rather narrow. Postorbitals largest in suborbital chain. Cranium and suborbitals with mucous canals, some arborescent. Opercles with traces of very faint radiating striæ. Gill-flap narrow.

Gill-opening extending forward till nearly opposite posterior margin of pupil. Rakers in form of  $4? + 8?$  or more short inconspicuous fleshy points along outer edge of first branchial arch. Filaments long, series on inner edge of first arch longer, equalling about  $\frac{1}{2}$  of orbital diameter. Isthmus broad. Branchiostegals 4, large, well developed and subequal.

Scales rather small, striate, rather smooth, in even longitudinal or horizontal series parallel with lateral line, and of more or less even size. Small scales along bases of dorsal and anal and on that of caudal. Ventral with a rather short pointed scaly flap about  $\frac{1}{2}$  length of (damaged) fin. Predorsal region with a median keel. Postdorsal region rounded. Upper and lower surfaces of caudal peduncle flattened. Preventral region flattened posteriorly, and with a low or obsolete keel anteriorly. Postventral region trenchant and with an obsolete keel on each side, convergent posteriorly. Lateral line continuous, median on side, extending on base of caudal, decurved a little in front, and mostly of simple tubes except those on first 6 scales which are arborescent.

Origin of dorsal falling in vertical about midway between tip of snout and origin of adipose fin, rays long, first branched one apparently highest, and others graduated down so that last one is less than half length of first. Adipose dorsal small, its base over bases of posterior anal rays. Anal inserted nearly midway between base of last dorsal ray and base of caudal, anterior rays longest and edge of fin a little concave. Caudal emarginate, lobes apparently broad. Pectoral low,

pointed or upper rays longest, and reaching ventral. Ventral inserted about opposite first third of base of dorsal. Vent close in front of anal.

Color in alcohol pale or dull brownish more or less silvered or with brassy reflections. Back with pale or dull purplish reflections becoming very dilute greenish on sides. Each scale more or less paler on outer or exposed portion, so that rather pale longitudinal lines are formed on back. Upper surface of head brownish, sides and lower surface silvered. Fins all pale brownish, dorsal with about eight dusky cross-bands. Caudal with a median blackish band from center of its base to tips of median rays, and each lobe with three oblique bands of similar color, but broader anteriorly. Anal with three horizontal dusky bands, lowest near tips of anterior rays, median beginning at origin of fin, and upper at posterior rays. Pectoral and ventral plain. Iris brownish.

Length  $4\frac{3}{8}$  inches.

Type, No. 21,350, A. N. S. P. Lower Amazons. Prof. J. Orton. Coll. of 1874. Prof. E. D. Cope. One example.

This species is also apparently closely related to *Prochilodus insignis* Jardine, but differs in the fewer blackish bars on the caudal lobes. It will possibly prove identical with the examples recorded by Dr. Günther which have three dark bars on each caudal lobe.

(Named for the Amazon river of South America, also written Amazons and Amazonas. The name Amazon is said to be derived from the Indian word Amassona or "boat-destroyer," with reference to the destructive tidal phenomenon or proroca.)

HEMIODOPSIS subgen. nov.

Type *Hemiodus microlepis* Kner.

This group is distinguished from subgenus *Hemiodus* Müller and Troschel by the small scales in a lateral count, at least 100 or more.

(*Hμi*, half; *δδovς*, tooth; *δψis*, appearance, with reference to the subgenus *Hemiodus*.)

*Hemiodus microlepis* Kner.

Cope, Proc. Acad. Nat. Sci. Phila., 1871 (1872), p. 291. Between the mouth of the Rio Negro and the Peruvian Amazon. Robert Perkins.—  
Cope, Proc. Amer. Philos. Soc. Phila., XVII, 1877-78 (May 17, 1878), p. 686. Peruvian Amazon. Prof. J. Orton.

Head 4; depth  $3\frac{2}{5}$ ; D. III, 9, 1; A. III, 9, 1; scales about 105 (squamation injured) in lateral line to base of caudal, and 7 more on latter; about 24? scales obliquely back from origin of dorsal to lateral line; about 12? scales between lateral line and origin of ventral, and about same number between former and origin of anal; snout  $3\frac{1}{2}$  in head; eye

4½; interorbital space 3; pectoral 1½; ventral 1½; least depth of caudal peduncle 2½. Eye midway in depth of head. Gill-opening extending forward till about opposite middle of orbit. Rakers 22? + 38?, compressed, cuneated triangularly, and inner edge of each ciliate. Gill-filaments about equal to ½ of orbital diameter. Scales above pectoral anteriorly, both above and below lateral line, and on breast, enlarged. Scales on base of caudal also a little large. Scales on post-dorsal region of back formed into more or less convergent series and larger than those just below. Lower lobe of caudal much longer than upper, just the reverse of that indicated by Kner. Length 9 inches (caudal damaged). One example from Robert Perkins, taken between the mouth of the Rio Negro and the Peruvian Amazon.

Also two smaller examples from the Peruvian Amazon. Prof. J. Orton. Coll. 1873 and 1877. Prof. E. D. Cope. These both show about 120 scales in lateral line to base of caudal, and 7 or 8 more on latter. Middle of lower lobe of caudal dusky longitudinally, and deepest basally. The Perkins example shows this as faint.

#### CITHARININÆ.

*Citharinus eitharus* (Geoffroy St. Hilaire).

*Citharinus geoffroyi* Günther, Proc. Zool. Soc. London, 1896 (February 4), p. 223. Lake Rudolf. Dr. A. D. Smith.

Head 2½; depth 2½; D. iv, 14, 1; A. v, 24, 1; scales 83 in lateral line to base of caudal, and 5 more on latter; 21 scales in a vertical series between origin of dorsal and lateral line; 17 scales between origin of anal and lateral line in a vertical series; snout 4½ in head; eye 3½; width of mouth 3; interorbital space 3; base of dorsal 1½; base of anal 1½; least depth of caudal peduncle 3½; pectoral 1½; ventral 1½. Back rather elevated, profile forming an angle at origin of dorsal. Lower profile of body more or less evenly convex. Head becoming compressed below. Snout short and broad. Eye about circular. Interorbital space broad and a trifle convex. Gill-rakers not evident. Color in alcohol, back brownish from a little above lateral line, and lower surface and side silvery-white. Fins pale brownish. Iris pale straw-color. Length 2½ inches. Two examples, the other a little smaller. They both differ from the original figure of Geoffroy St. Hilaire in the straight upper anterior profile.

PITHECOCHARACINÆ subfam. nom. nov.

(*Anostominae* Auct.)

**PITHECOCHARAX** gen. nov.

Type *Salmo anostomus* Linnæus.

Snout narrow and conic, and mouth superior.

This name is proposed as *Anostomus* Klein, in Walbaum, *Pet. Arted. Gen. Pisc.*, III, 1792, p. 659 (type *Salmo anostomus* Linnæus) = Gray, *Cat. Brit. Mus. Fish. Gron.*, 1854, p. 153, is preoccupied in Ornithology by *Anastomus* Bonnaterre, *Enc. Méth. Ornith.*, 1790, p. xciii.

(*Πιθηκος*, ape, with reference to the short snout or nose; *χαράξ*, Charax.)

***Pithecocharax trimaculatus* (Kner).**

*Schizodon trimaculatus* Cope, Proc. Amer. Philos. Soc. Phila., XVII, 1877-78 (May 17, 1878), p. 690. Peruvian Amazon. Prof. James Orton. Coll. of 1877.

Head 4; depth 3; D. II, 10, 1; A. III, 8, 1; scales 40 in lateral line to base of caudal, and 2 more on latter; about 16 scales before dorsal; 6 scales obliquely back from origin of dorsal to lateral line; 6 scales obliquely up from origin of ventral to lateral line; 5 scales obliquely up from origin of anal to lateral line; pectoral  $1\frac{1}{2}$  in head; ventral  $1\frac{1}{2}$ ; snout 3 in head, from tip of upper jaw; eye  $3\frac{1}{4}$ ; interorbital space  $2\frac{1}{10}$ . Rakers absent. Color in alcohol with each scale marked medianly with a pale area so that longitudinal series are formed, becoming convergent posteriorly. Length  $5\frac{1}{2}$  inches (caudal damaged).

Also another, 3 inches long, with same data. The opercular blotch, on both of my examples, appears to be superior according to such traces of it as remain, rather than inferior as indicated on Kner's figure.

***Pithecocharax ucayalensis* sp. nov. Fig. 16.**

Head 3; depth  $3\frac{1}{2}$ ; D. III, 10; A. III, 8, 1; P. I, 12?; V. I, 8; scales about 33? in lateral line to base of caudal (squamation injured), and apparently several more on latter; about 5? scales between origin of dorsal, obliquely back, and lateral line; about 4? scales between lateral line and origin of anal; width of head about  $2\frac{1}{2}$  in its length; depth of head, over middle of orbit, about 2; least depth of caudal peduncle  $3\frac{1}{2}$ ; snout  $3\frac{1}{2}$  in head, measured from tip of upper jaw; eye 3; interorbital space 3.

Body elongate, compressed, back a little elevated or with upper profile a little more convex than lower, and greatest depth about middle of predorsal region. Predorsal, postdorsal, and preventral regions (desquamated) apparently rounded. Postventral region possibly with median keel? Caudal peduncle compressed, and least depth about  $\frac{3}{4}$  its length.

Head compressed, elongate, and attenuate inferiorly, or with upper profile much more inclined than lower. Snout short, moderately broad, straight in profile and upper surface convex. Eye circular and

a little anterior. Mouth superior and mandible well protruding in front, cleft nearly vertical. Maxillary small and vertical. Teeth large, sharp, crenulate, uniserial, and two median mandibulars largest and most conspicuous. Tongue rather broad; rounded, and hardly free. Anterior nostril in a fleshy tube about equal to diameter of pupil in length, lateral, and nearly midway in length of snout. Posterior nostril large, a little inclined, slit-like, and close to middle of anterior rim of orbit. Interorbital space broad and nearly flattened.

Gill-opening extending about opposite posterior margin of pupil.

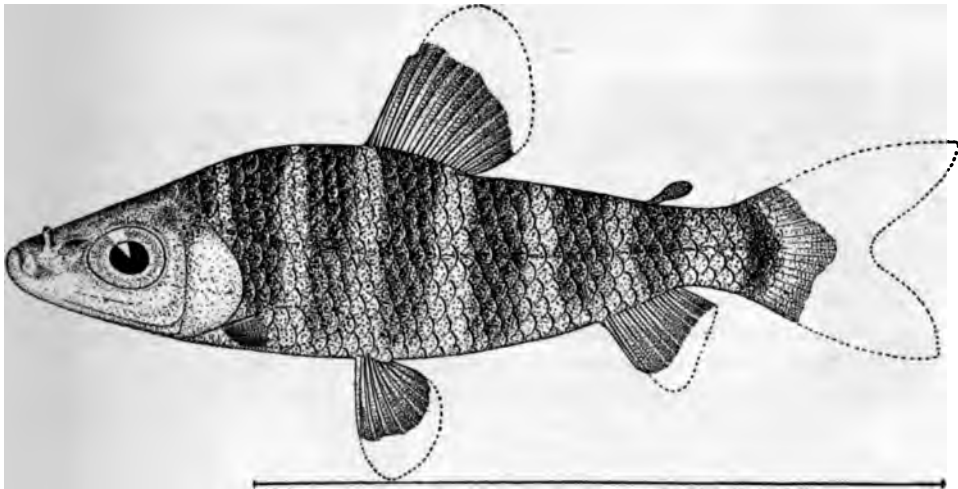


Fig. 16.—*Pithecocharaz ucayalensis* Fowler.

Rakers short weak fleshy protuberances, and moderately numerous. Filaments well developed.

Scales mostly fallen, large, evidently in rows parallel with lateral line, and also apparently all of more or less even size. Base of caudal apparently scaly. Lateral line evidently complete, and of simple tubes.

Origin of dorsal nearly midway between tip of mandible and base of caudal. Origin of adipose fin placed about last fourth in space between origin of dorsal and base of caudal. Anal inserted well behind dorsal, or near middle of space between end of ventral and base of caudal. Pectoral low, and though damaged apparently not reaching ventral. Ventral inserted a short distance before origin of dorsal, and though also damaged not reaching perhaps more than half way to anal.

Color in alcohol brown, lower surface and fins paler. Body with

about seven broad ill-defined dark brown or dusky transverse bands. First three nuchal or predorsal, fourth from base of dorsal, fifth and sixth from postdorsal region, and seventh from base of adipose fin. Fins pale, caudal lighter and with a subbasal transverse blackish line. Iris brownish.

Length (caudal damaged)  $1\frac{1}{2}$  inches.

Type, No. 21,997, A. N. S. P. Peruvian Amazon or Ucayale River. Prof. J. Orton. Coll. Prof. E. D. Cope.

This species is distinguished from *Pithecocharax anostomus* (Linnæus) and *P. trimaculatus* (Kner) chiefly by the coloration.

(Named for the Ucayale or Ucayali River, sometimes called Peruvian Amazon or Paro.)

***Schizodon fasciatus* Agassiz.**

Cope, Proc. Amer. Philos. Soc. Phila., XI, 1869-70 (August 19, 1870), p. 566. Para. De Schulte Buckow. —Cope, *l.c.*, XVII, 1877-78 (May 17, 1878), p. 689. Peruvian Amazon. Prof. J. Orton.  
*Anostomus fasciatus* Cope, Proc. Acad. Nat. Sci. Phila., 1871 (1872), p. 258. Ambyiacu River, Ecuador. John Hauxwell.

Head  $3\frac{1}{2}$ ; depth  $3\frac{1}{2}$ ; D. II, 9, 1; A. II, 8, 1; scales 37 in lateral line to base of caudal, and 4 more on latter; 11 scales before dorsal; 5 scales obliquely back from dorsal to lateral line; 5 scales obliquely up from origin of ventral to lateral line; 4 scales obliquely up from origin of anal to lateral line; pectoral  $1\frac{3}{4}$  in head; ventral  $1\frac{1}{2}$ ; snout  $2\frac{2}{3}$  in head, from tip of upper jaw; eye  $3\frac{1}{2}$ ; interorbital space 2. Rakers none. Coloration faded dull brown. Length  $6\frac{1}{2}$  inches (caudal damaged). Para, Brazil. De Schulte Buckow. Prof. E. D. Cope.

Three examples from the Peruvian Amazon, the largest about  $7\frac{1}{2}$  inches in length, show: Head  $3\frac{3}{8}$  to 4; depth  $3\frac{1}{2}$  to  $3\frac{3}{4}$ ; D. II, 10, 1; A. III, 8, 1; scales 38 to 40 in lateral line to base of caudal, and 4 on latter. The color-pattern is constant. None of my examples show the dark transverse bar on the lower caudal lobe figured by Agassiz. The dark bars on the trunk are not absolutely vertical, the first two at least inclined a little back. They are also placed about equal in space and not extending across the ventral surface. Agassiz also indicates the eye too low in depth of head.

One example from the Ambyiacu,  $7\frac{1}{2}$  inches long (caudal damaged). John Hauxwell. It agrees with the Orton examples.

***Lasmolyta taeniata* (Kner).**

Cope, Proc. Acad. Nat. Sci. Phila., 1871 (1872), p. 259. Ambyiacu River, Ecuador. John Hauxwell.

Head 4; depth 5; D. II, 10, 1; A. III, 8, 1; scales 37 in lateral line to base of caudal, and 5 more on latter; 5 scales obliquely back from

origin of dorsal to lateral line; 4 scales obliquely up from origin of ventral to lateral line; 4 scales from origin of anal obliquely up to lateral line; 13 scales before dorsal; pectoral  $1\frac{1}{2}$  in head; ventral  $1\frac{1}{2}$ ; snout 3 in head, from tip of upper jaw; eye 3; interorbital space  $2\frac{1}{2}$ . Rakers none. Length  $4\frac{1}{2}$  inches (caudal damaged). Two examples.

The median dusky longitudinal band extends from the snout to the caudal. Kner's figure does not indicate it on the side of the snout or on the postocular region.

*PÆCILOSOMATOPS* subgen. nov.

Type *Characidium etheostoma* Cope.

Scales smaller transversely, about 4 from opposite origin of anal in an oblique series forward to lateral line.

(Ποικιλός, variegated; σῶμα, body; ὥψ, appearance. *Pæcilosoma* was an old name employed by Agassiz for certain *Etheostomatinae*, to which these fishes bear a certain resemblance.)

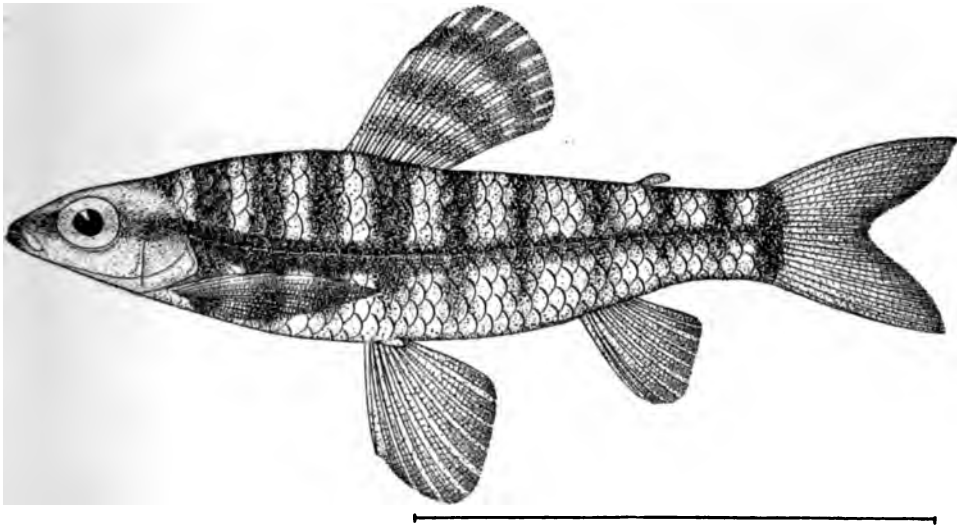


Fig. 17.—*Characidium etheostoma* Cope.

*Characidium etheostoma* Cope. Fig. 17.

Proc. Acad. Nat. Sci. Phila., 1871 (1872), p. 259, Pl. 13, fig. 3. No. 8,152 (type) and 8,153, A. N. S. P., cotypes. Ambyiacu River, Equador. John Hauxwell.

Scales 11 before dorsal; width of head about  $2\frac{1}{2}$  in its length; interorbital space  $3\frac{1}{2}$ . Body well compressed. Muzzle compressed. Snout rather narrow. Lips thin. Teeth in jaws uniserial, even and fine, none on maxillaries. Interorbital space convex. Gill-opening

extending forward opposite posterior margin of pupil. Rakers short, lanceolate and weak, in small number. Filaments well developed. Isthmus a little broad. Each scale with several radiating striæ. Vent placed about last  $\frac{2}{3}$  in space between origins of ventrals and anal. Color in alcohol brownish, lower surface paler, and fins still paler. Body with about eleven transverse brownish bands, at first of about equal width with alternate interspaces, but posteriorly interspaces becoming wider. First band nuchal, second and third predorsal, fourth just before origin of dorsal, fifth from middle of base of dorsal, sixth from just behind last dorsal ray, seventh and eighth from post-dorsal region with latter entirely in front of adipose fin, ninth and tenth across caudal peduncle, and eleventh which is dusky on base of caudal. A rather narrow deep brownish band from tip of snout across side of head and embracing lateral line to base of caudal. Dorsal with at least three brownish longitudinal rather narrow bands or lines, upper ones less distinct. Iris brassy-silvery. Length  $1\frac{1}{2}$  inches. Type.

From Dr. Steindachner's description it would hardly seem probable that his *Characidium purpuratum* is identical with *C. etheostoma*, in fact it falls in a different subgenus as the species are here understood if there are but  $2\frac{1}{2}$  to 3 scales between the origin of the anal and the lateral line.

Subgenus CHARACIDIUM Reinhardt.

Scales large transversely, about 3 from opposite origin of anal in an oblique series forward to lateral line.

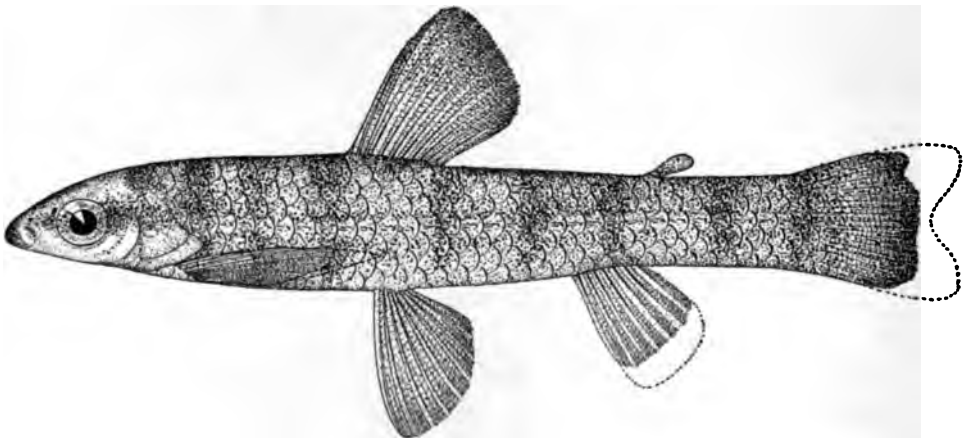


Fig. 18.—*Characidium steindachneri* Cope.



***Characidium steindachneri* Cope. Fig. 18.**

Proc. Amer. Philos. Soc. Phila., XVII, 1877-78 (May 17, 1878), p. 688. No. 21,428, A. N. S. P., type. Peruvian Amazon. Prof. J. Orton. Coll. of 1873.

Width of head  $2\frac{1}{2}$  in its length. Gill-opening extending forward about opposite middle of pupil. Vent about last fourth in space between origins of ventral and anal. Color in alcohol brownish with about 9 transverse distinct dusky bars. Fins all pale brownish. Iris brownish. Length about  $1\frac{1}{8}$  inches (caudal damaged). Otherwise like the preceding.

***Characidium tenuis* (Cope).**

*Chorimycerus tenuis* Cope, Amer. Nat., XXVII, 1894, p. 67. The upper waters of the Jacuhy River, in the Brazilian State of Rio Grande do Sul. H. H. Smith.—Cope, Proc. Amer. Philos. Soc. Phila., XXXIII, 1894 (January 5), p. 86, Pl. 5, fig. 3.

Head  $4\frac{2}{3}$ ; depth  $6\frac{2}{3}$ ; D. III, 9; A. III, 6, 1; scales 36 in lateral line to base of caudal and 2 more on latter; 4 scales obliquely back between origin of dorsal and lateral line; 3 scales obliquely back from origin of adipose fin to lateral line; 3 scales from opposite origin of ventral obliquely up and forward to lateral line; 3 scales obliquely forward and up from origin of anal to lateral line; 12 scales before dorsal; width of head 2 in its length; snout about  $4\frac{1}{8}$ ; eye  $3\frac{2}{3}$ ; maxillary  $4\frac{1}{2}$ ; interorbital space about 5; least depth of caudal peduncle  $2\frac{1}{2}$ ; length of depressed dorsal about 4; lower caudal lobe (damaged) about 4; pectoral  $4\frac{1}{2}$ ; ventral 5; depressed anal  $5\frac{1}{2}$ . Edges of trunk rounded. Gill-opening extending about opposite posterior margin of orbit. Rakers about 5 + 7, short, lanceolate and rather well separated. Filaments a little less than vertical diameter of orbit. Isthmus a little broad and triangular. Vent about first  $\frac{2}{3}$  in space between origins of ventrals and anals. Color in alcohol brownish, rather pale, especially below, and side with silvery reflections. Each scale of back with darker brown edge than shade of body-color. About 8 indistinct brownish transverse bars. Fins pale brownish, shaded with darker, anal and ventral a little lighter. Iris pale brownish. Length  $2\frac{2}{8}$  inches (caudal damaged). Type. The other example agrees.

This species is most closely related to *C. steindachneri* Cope, but differs chiefly in the slightly larger eye and more slender body.

The main character advanced for the nominal genus *Chorimycerus*, i.e., the presence of biserial mandibular teeth, is entirely fallacious, as both of the cotypes before me have but a single series in the mandible. It is therefore a synonym of *Characidium*.

## Subgenus RHYTIODUS Kner.

Scales small, 80 to 90 or more in a lateral series.

*Rhytiodus microlepis* Kner.

Head  $4\frac{1}{2}$ ; depth  $5\frac{1}{2}$ ; D. II, 10, 1; A. II, 8, 1; scales 77 in a lateral series to base of caudal, and 8 more on latter; 12 scales obliquely back from origin of dorsal to lateral line; 9 scales obliquely up posteriorly from origin of ventral to lateral line; 8 scales from origin of ventral in a similar way; about 23? (squamation damaged) scales before dorsal; snout  $2\frac{1}{2}$  in head; eye 5; interorbital space 2; pectoral  $1\frac{1}{2}$ ; ventral  $1\frac{1}{2}$ ; least depth of caudal peduncle  $2\frac{1}{2}$ . Small short slender weak gill-rakers developed on outer edge of first arch. Pebas, Equador. Prof. J. Orton. Coll. 1873-77. Prof. E. D. Cope.

## GARMANINA subgen. nov.

Type *Rhytiodus argenteo-fuscus* Kner.

Restricted to those species of *Rhytiodus* Kner with large scales, about 50 to 60 in a lateral series.

(Named for Prof. Samuel Garman, of Cambridge, Mass., author of many excellent contributions to Ichthyology.)

*Rhytiodus argenteo-fuscus* Kner.

*Schizodon sagittarius* Cope, Proc. Amer. Philos. Soc. Phila., XVII, 1877-78 (May 17, 1878), p. 689. No. 21,474, A. N. S. P., type. Peruvian Amazon. Prof. J. Orton. Coll. of 1877.

Head  $4\frac{1}{2}$ ; depth  $5\frac{1}{2}$ ; D. III, 10; A. III, 8; scales 47 in lateral line to base of caudal, and 5 more on latter; 7 scales obliquely back from origin of dorsal to lateral line; 4 scales obliquely back from origin of adipose fin to lateral line; 6 scales obliquely up from origin of anal to lateral line; about 16 scales before dorsal; width of head  $1\frac{1}{2}$  in its length; depth of head over middle of orbit  $2\frac{1}{2}$ ; least depth of caudal peduncle 3; pectoral  $1\frac{1}{2}$ ; ventral  $1\frac{1}{2}$ ; depressed dorsal  $4\frac{1}{2}$ ; fourth anal ray  $1\frac{1}{2}$ ; snout  $2\frac{1}{2}$  in head measured from tip of upper jaw; eye about  $4\frac{1}{2}$ ; interorbital space  $2\frac{1}{2}$ . Body tapering evenly back from opposite origins of dorsal and ventral. Predorsal region with an obtuse median keel. Postdorsal region flattened. Preventral region rounded, except region right at bases and just before ventrals, which is flattened. Post-ventral region apparently rather rounded. Least depth of caudal peduncle about half its length. Head depressed above and below anteriorly, and with convex surface. Snout broad, rounded when viewed above. Width of mouth about  $\frac{3}{4}$  of orbit. Teeth broadly expanded or compressed. Maxillary reaching about to posterior nostril. Anterior nostril in a short tube. Interorbital space broadly convex. Gill-opening extending forward about opposite last fourth in

head. Rakers short, not numerous and weak. Filaments equal orbit. Isthmus broad and convex. Scales non-striate. Ventral scaly flap  $\frac{2}{3}$  of fin. Pectoral reaching  $\frac{2}{3}$  of space to ventral, and ventral  $\frac{2}{3}$  to anal. Vent close in front of anal. Color in alcohol brownish, upper  $\frac{2}{3}$  of body darker and sharply demarcated from lower or whitish surface, and former color extending well below lateral line. Dorsal and caudal brownish, especially middle of each lobe of latter. Pectoral, ventral and anal pale brownish, especially latter. Line of demarcation on sides pronounced by a longitudinal lateral band extending from tip of snout to base of caudal. Iris brownish. Length  $6\frac{3}{8}$  inches.

Prof. Garman's view that this is the young of *R. argenteo-fuscus* Kner is fully established, as I find that the mandible has 8 teeth rather than 6 as stated by Cope.

***Leporellus vittatus* (Valenciennes).**

*Leporinus vittatus* Cope, Proc. Amer. Philos. Soc. Phila., XVII, 1877-78 (May 17, 1878), p. 690. Peruvian Amazon. Prof. J. Orton. Coll. of 1877.

Head  $3\frac{1}{2}$ ; depth  $3\frac{1}{2}$ ; D. III, 10, 1; A. III, 8; P. II, 16; V. II, 8; scales 37? (squamation injured) in lateral line to base of caudal, and 5? more on latter; 5 scales obliquely back from origin of dorsal to lateral line; 4 scales obliquely up posteriorly from origin of ventral to lateral line; 14? scales (squamation injured) before dorsal; snout  $2\frac{1}{2}$  in head; eye 4; interorbital space  $2\frac{1}{2}$ ; least depth of caudal peduncle 3. Gill-rakers short weak fleshy processes. Color in alcohol with back sharply defined from that of band running along lateral line, which is also well defined and dark. A narrow line on flank, well below lateral line, extending from base of pectoral to origin of anal. Top of head with indistinct brownish spots. Dorsal blackish with a broad transverse whitish band below middle. Length  $2\frac{1}{2}$  inches.

Castelnau figures *Leporinus vittatus* Valenciennes, which will be seen to differ at once in the coloration. It shows each scale of the back marked with a single black spot and the dorsal crossed by a blackish transverse band a little above its middle. The side of the head is spotted, and there are also no traces on the trunk of the dark contrasted color-pattern which my example now shows. Kner's figure of *Leporinus pictus* agrees better, and though it differs according to the figure in having a pale dorsal marked above and in front with a dark blotch, another or basal one is mentioned in the description. The figure also shows no trace of the lower dusky line seen on my example, which extends from the pectoral to the anal. Dr. Steindachner records a large example from Cauca which had both dorsal and anal fins marked with blackish bands.

*Leporinus fasciatus* (Bloch).

Head  $3\frac{1}{2}$ ; depth  $2\frac{1}{2}$ ; D. III, 10, 1; A. III, 8, 1; scales 34 in lateral line to base of caudal, and 5 more on latter; 6 scales obliquely back from origin of dorsal to lateral line; 5 scales obliquely up from origin of ventral to lateral line; 5 scales obliquely forward from origin of anal to lateral line; 12 scales before dorsal; snout  $2\frac{1}{2}$  in head; eye  $4\frac{1}{2}$ ; inter-orbital space  $2\frac{2}{3}$ ; pectoral  $1\frac{1}{2}$ ; ventral  $1\frac{1}{2}$ ; least depth of caudal peduncle  $2\frac{1}{2}$ . Middle of orbit a little anterior in head. Rakers 5 + 8, denticle-like, compressed and weak. Predorsal and postdorsal regions rounded. Very slight lateral keel on each side of postventral region, and also one on each side of preventral region. Median line of both these areas also with a slight keel, that of latter most pronounced. In coloration it agrees largely with Bloch's figure. The occipital band is broader. First band on trunk forking above, second inclined to base of pectoral, sixth also forked above and extending towards origin of anal, seventh from base of adipose fin to bases of last anal rays, and last or ninth in form of large blotch at base of caudal. An indistinct brownish bar about opposite middle of pectoral and a blotch near its tip or above base of ventral. Traces of two transverse caudal bands. Length  $5\frac{1}{2}$  inches (caudal damaged). Rio Parahyba, Brazil. Museum of Comparative Zoology, Massachusetts. One example.

*Leporinus friderici* (Bloch).

*Leporinus frederici* Cope, Proc. Amer. Philos. Soc. Phila., XI, 1869-70 (August 19, 1870), p. 566. Pebas, Eastern Peru. John Hauxwell.—Cope, *l.c.*, XVII, 1877-78 (May 17, 1878), p. 690. Peruvian Amazon. Prof. J. Orton.

Head  $3\frac{1}{2}$  to  $3\frac{1}{4}$ ; depth  $3\frac{1}{2}$  to  $3\frac{2}{3}$ ; D. II or III, 10, 1; A. III, 8, 1; scales 33 to 35 in lateral line to base of caudal, and usually 4 more on latter; 11 to 13 scales before dorsal; 5 scales in an oblique series back from origin of dorsal to lateral line; 5 scales obliquely forward from origin of ventral to lateral line; 5 scales obliquely forward from origin of anal to lateral line; snout  $2\frac{2}{3}$  to 3 in head; eye  $3\frac{2}{3}$  to  $4\frac{1}{2}$ ; interorbital space 2 to  $2\frac{1}{4}$ . Gill-rakers slender short denticles usually a little bent distally, and about 20? on first arch. Color in alcohol very dark, base of each scale darker than other portion, and line of demarcation very distinct, so that an imbricated appearance is assumed. In smaller examples pectoral approaches nearer ventral than in adults. Total length of 7 examples  $3\frac{1}{2}$  to 9 inches. Peruvian Amazon. Prof. J. Orton. Coll. of 1877.

Two examples from Pebas. John Hauxwell. Both show about same number of scales as preceding. The smaller one has the dark lateral blotches more or less confluent posteriorly, as described by Dr. Günther.

The above specific name is restored in the original, for in all cases Bloch spelled it exactly as above.

*Leporinus multifasciatus* Cope. Fig. 19.

Proc. Amer. Philos. Soc. Phila., XVII, 1877-78 (May 17, 1878), p. 690.  
Peruvian Amazon. Prof. J. Orton.

*Leporinus megalepis* Cope, l.c., XI, 1869-70 (May 19, 1870), p. 566. Para.  
De Schulte Buckow.—Cope, Proc. Acad. Nat. Sci. Phila., 1871 (1872),  
p. 259. Ambyiacu River, Equador. John Hauxwell.

The cotypes of *L. multifasciatus*, Nos. 21,448 (type) to 21,450, A. N. S. P., are in very poor condition, though they appear to be identical with the other material. The largest shows: Head  $3\frac{1}{2}$ ; depth  $3\frac{3}{4}$ ; D. II, 10; A. IV, 8; width of head 2 in its length; depth of head over middle of orbit 2; snout 3 in head from tip of upper jaw; eye  $3\frac{1}{2}$ ; interorbital space  $2\frac{1}{2}$ ; least depth of caudal peduncle  $2\frac{1}{2}$ . Though dark lateral blotches are not present they may have faded. Length of type  $2\frac{1}{2}$  inches.

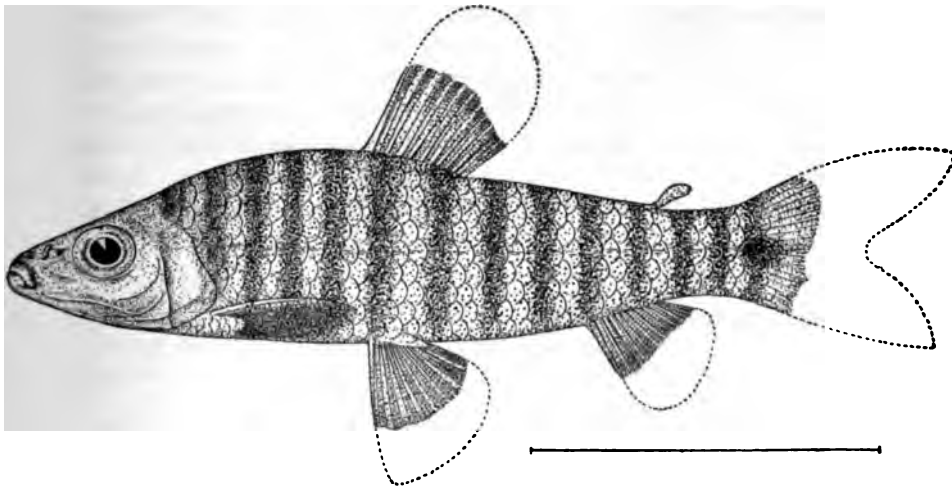


Fig. 19.—*Leporinus multifasciatus* Cope.

The example from Para has very indistinct bands on the back and a rather long pectoral.

The largest of the Hauxwell examples shows: Head  $3\frac{1}{2}$ ; depth 3; D. III, 10, 1; A. III, 8, 1; scales 33 in lateral line to base of caudal, and 4 more on latter; 5 scales obliquely back from origin of dorsal to lateral line; 4 scales obliquely up from origin of anal to lateral line; 10 scales before dorsal; width of head  $1\frac{1}{2}$  in its length; third dorsal ray  $1\frac{1}{2}$ ; third anal ray  $1\frac{1}{2}$ ; pectoral  $1\frac{1}{2}$ ; ventral  $1\frac{1}{2}$ ; least depth of caudal peduncle  $2\frac{1}{2}$ ;

snout  $2\frac{1}{2}$  in head from tip of upper jaw; eye  $3\frac{1}{2}$ ; maxillary  $4\frac{1}{2}$ ; interorbital space  $2\frac{1}{2}$ ; upper caudal lobe nearly 3 in head and trunk. Predorsal region rounded at first and posteriorly with a median keel extending to dorsal fin. Postdorsal region rounded, also preventral region. Postventral region with a median obscure keel. Head broad, depressed in front, rounded below and sides somewhat compressed. Snout when viewed above broad and triangular with rounded tip. Width of mouth about  $\frac{1}{2}$  of orbit. Maxillary about half way in snout. Lips fleshy. Teeth 8 in each jaw, anterior largest, and 2 median mandibulars especially conspicuous. Tongue rather far back, narrow, and not free. Interorbital space broadly convex. Gill-opening extending forward about first third in head. Rakers  $10 + 14?$ , short, lanceolate, and longest about half of longest filaments which are  $\frac{1}{2}$  of orbit. Vent close in front of anal. Color in alcohol faded brownish, a little darker on back and upper surface. About 14 indistinct bars of deeper brownish than body-color across back, and each one also narrower than pale interspace. In some cases they become faded altogether on side, and frequently indistinct traces occur below. Three blotches of deep brownish, larger than eye, along middle of side. First blotch midway in length of trunk, and second midway between it and third, which is on base of caudal. Dorsal, caudal and pectoral pale, and anal and ventral dusky or deep brown. Iris brown. Teeth warm brownish marginally. Length  $4\frac{1}{2}$  inches. Identified with *L. megalepis* Günther, but that species is said to have the body with large blackish spots arranged in 2 or 3 series.

*Leporinus helectistus* Cope. Fig. 20.

Cope, Proc. Amer. Philos. Soc. Phila., XVII, 1877-78 (May 17, 1878), p. 690. Nos. 21,467 (type) and 21,468, A. N. S. P., cotypes. Peruvian Amazon. Prof. J. Orton. Coll. of 1877.

Width of head  $2\frac{1}{2}$  in its length; interorbital space  $2\frac{1}{2}$ . Predorsal, postdorsal and preventral regions rounded. Postventral region with an obsolete median keel, and another on each side. Snout broad and triangular seen from above. Lips fleshy. Teeth 8 in each jaw, anterior ones largest, and 2 median mandibulars conspicuous. Tongue rather far back, narrow and not free. Interorbital space broadly convex. Gill-opening extending forward about last fourth in length of head. Rakers  $3 + 11?$ , short, lanceolate, and longest about  $\frac{1}{2}$  of longest filaments, which are  $\frac{1}{2}$  of orbit. Scales non-striate. Color in alcohol brownish, and lower surface paler or whitish. Body with 10 broad transverse bands as wide as interspaces. First includes or extends over snout, second over interorbital space, third on occiput,

fourth on middle of predorsal region, fifth just before dorsal, sixth vertically across dorsal so that its posterior margin is even with last ray and then down till behind ventral, seventh on postdorsal region anteriorly, eighth on postdorsal region posteriorly till down just in front of anal, ninth behind adipose fin and continued transversely

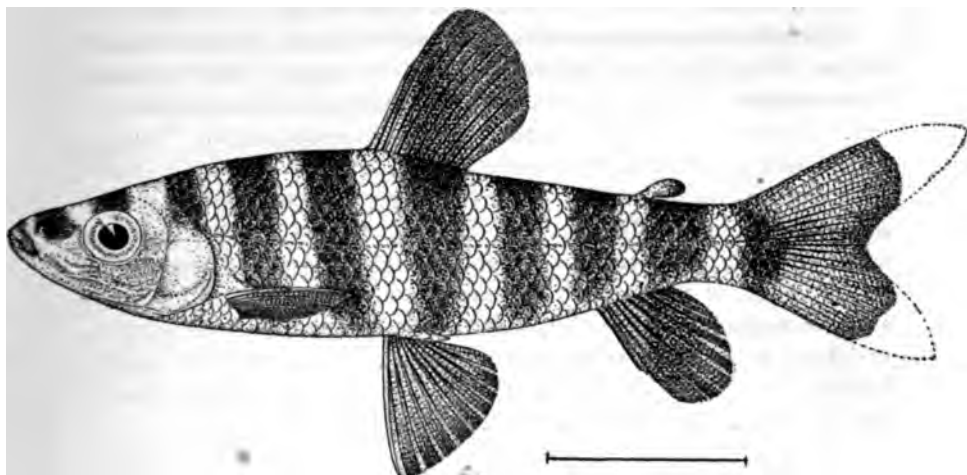


Fig. 20.—*Leporinus holostictus* Cope.

across anal, and tenth at base of caudal. Fins otherwise all more or less unmarked, except posterior margin of caudal which is dusky. Iris brownish. Length  $4\frac{1}{2}$  inches (caudal damaged). Type. The other example shows the depth as  $3\frac{1}{2}$ .

**ABRAMITES** gen. nov.

Type *Leporinus hypselonotus* Günther.

Closely related to *Leporinus* Agassiz, but distinguished by the larger anal basis.

(*Abramites*, from *Abramis*, *Bresma* and *Prasmus*, old names applied to *Brama brama* or the common European bream. The reference is to the superficial appearance.)

***Abramites hypselonotus*** (Günther).

*Leporinus hypselonotus* Cope, Proc. Amer. Philos. Soc. Phila., XVII, 1877-78 (May 17 1878), p. 690. Peruvian Amazon. Prof. J. Orton. Coll. of 1877.

Head  $3\frac{1}{2}$ ; depth  $2\frac{3}{4}$ ; D. III, 10; A. III, 12, 1; scales 34 in lateral line to base of caudal, and 4 more on latter; snout  $3\frac{1}{2}$  in head from tip of upper jaw; eye 3; interorbital space  $2\frac{3}{4}$ . Length  $2\frac{1}{2}$  inches.

Dr. Günther's excellent figure largely agrees, though my example

shows traces of an interorbital band and a nuchal one extending down just behind opercle.

#### TETRAGONOPTERINÆ.

*Cheirodon monodon* (Cope).

*Chirodon monodon* Cope, Proc. Amer. Philos. Soc. Phila., XXXIII, 1894 (January 5), p. 91, Pl. 6, fig. 9. Nos. 21,561 (type) and 21,562, A. N. S. P., cotypes. Brazilian province of Rio Grande do Sul. H. H. Smith.

Edge of back rounded, except a little before spinous dorsal and upper surface of caudal peduncle where it is a little trenchant. Belly rounded. Postventral region and lower surface of caudal peduncle a little trenchant. Each ramus of mandible elevated a little inside mouth. Tongue rather large, flattened, moderately broad and free in front. Interorbital space convex. Gill-opening extending forward nearly opposite anterior margin of orbit. Rakers 12 + 12 on first arch, lanceolate, and longest a little shorter than filaments, which are a little longer than pupil. Isthmus narrowly triangular. Vent close in front of anal. Color in alcohol pale brownish, back a little darker than lower surface, and body everywhere more or less silvered. A pale or dull leaden-brassy streak from above eye back to caudal. Fins all pale or immaculate brownish. Iris dull silvery. Length  $1\frac{1}{8}$  inches. Type.

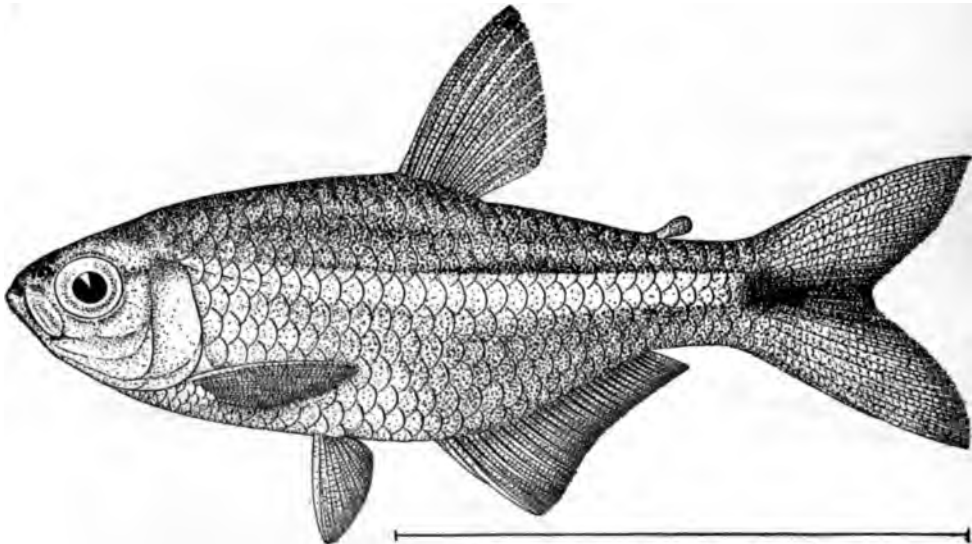


Fig. 21.—*Cheirodon pulcher* (Steindachner).

*Cheirodon pulcher* (Steindachner). Fig. 21.

*Tetragonopterus diaphanus* Cope, Proc. Amer. Philos. Soc. Phila., XVII, 1877-78 (May 17, 1878), p. 691. Peruvian Amazon. Prof. J. Orton. (Part.)



Edges of body but little trenchant, or only upper and lower surfaces of caudal peduncle and postventral region. Rami of mandible well elevated inside mouth. Rakers 10 + 14 on first arch, lanceolate, and longest about length of filaments which are  $\frac{3}{4}$  of orbit. Scales non-striate. Color in alcohol brownish, back darker and lower surface paler, washed everywhere with more or less silvery. A dull leaden streak, a little high, from below dorsal to caudal and then continued out on its middle rays as dusky. Fins otherwise all dull brownish. Iris dull brassy. Length  $1\frac{1}{2}$  inches.

Two examples, wrongly identified by Cope with *Astyanax diaphanus*.

**Aphyocharax pusillus** Günther. Fig. 22.

Cope, Proc. Acad. Nat. Sci. Phila., 1871 (1872), p. 260. Ambyiacu River, Eastern Ecuador. John Hauxwell.—Cope, Proc. Amer. Philos. Soc. Phila., XVII, 1877-78 (May 17, 1878), p. 689. Peruvian Amazon. Prof. J. Orton.

Interorbital space  $2\frac{1}{2}$  in head. Snout convex. Rami of mandible but little elevated inside of mouth. Tongue a little elongate, fleshy and free in front. Interorbital space broad and a little convex. Gill-openings extending forward till nearly opposite front margin of pupil.

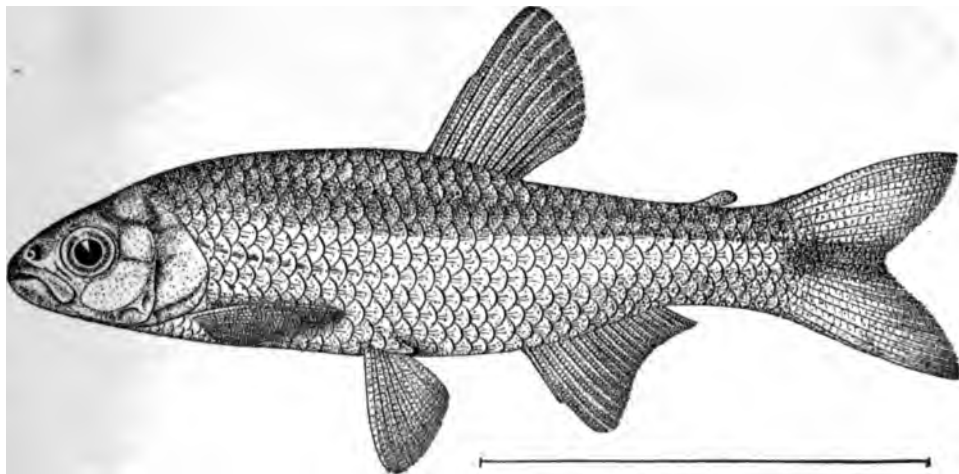


Fig. 22.—*Aphyocharax pusillus* Günther.

Rakers 7 + 8, short, pointed, and much less than filaments. Isthmus narrow and with median groove. Each scale with 2 or 3 striæ. Color in alcohol brown, sides paler, and body more or less brassy. Fins brownish, median caudal rays dusky. Iris brownish. Length  $2\frac{5}{8}$  inches. Peruvian Amazon. Orton. Coll. of 1873.

Three examples from the Ambyiacu in the Hauxwell Coll. Head  $3\frac{1}{2}$  to  $3\frac{3}{4}$ ; depth  $3\frac{1}{2}$  to 4; D. II, 9; A. III or IV, 16, I to 18, I; scales 32 to 34 in lateral line (squamation mostly injured) to base of caudal, and 2 more on latter; total length 2 to  $2\frac{1}{2}$  inches.

*Aphyocharax filigerus* Cope. Fig. 23.

Proc. Amer. Philos. Soc. Phila., XI, 1869-70 (August 19, 1870), p. 564. Nos. 8,059 (type) and 8,073, A. N. S. P., cotypes. Pebas, Eastern Equador. John Hauxwell.

Interorbital space 3 in head. Edges of trunk apparently more or less rounded. Rami of mandible hardly elevated inside mouth. Tongue a little long, narrow and free in front. Interorbital space elevated convexly. Gill-openings carried forward about first  $\frac{2}{3}$  of

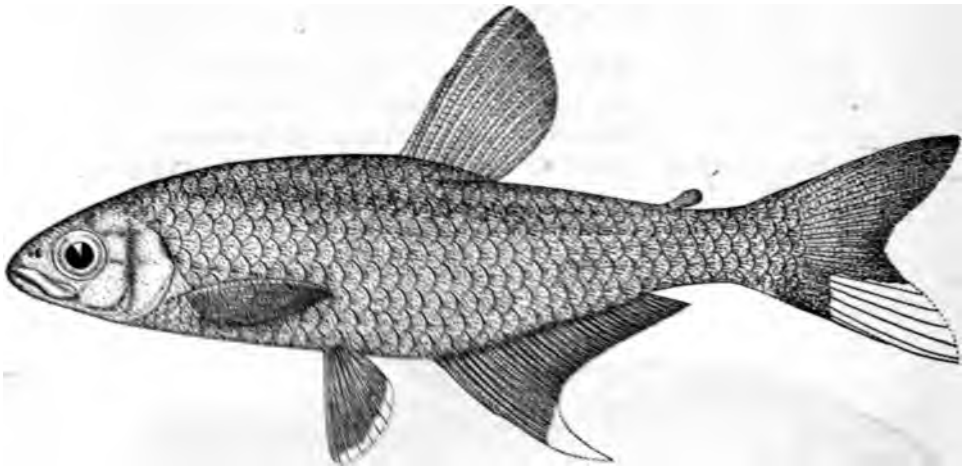


Fig. 23.—*Aphyocharax filigerus* Cope.

orbit. Rakers 7 + 10, lanceolate, and apparently longer than longest filaments or a little longer than half of orbit. Isthmus narrow. Color in alcohol faded dull brownish, and fins pale, though median caudal rays a little paler than rest of fin. Iris brownish. Length  $2\frac{1}{4}$  inches (caudal damaged). Type. Taken from the stomach of a siluroid.

*Diapoma speculiferum* Cope.

Amer. Nat., XXVIII, 1894, p. 67. No. 21,580, A. N. S. P., type. Upper waters of the Jacuhy River in Brazilian State of Rio Grande do Sul. H. H. Smith.—Cope, Proc. Amer. Philos. Soc. Phila., XXXIII, 1894 (January 3), p. 92, Pl. 3, fig. 4, from type.

Edge of back rounded. Upper and lower edges of caudal peduncle trenchant. Chest with a median rounded ridge. Postventral region

trenchant. Snout convex. Tongue small, a little back, narrow, and a little free. Interorbital space narrowly convex. Gill-opening carried forward nearly opposite anterior margin of orbit. Rakers 6 + 12?, slender, fine, longest a little longer than filaments and also present on lower portion of external arch. Isthmus rather broadly triangular. Scales striate. Vent close in front of anal. Color in alcohol more or less brownish, back more brown than lower surface and body with silvery wash. A leaden lateral streak from head opposite eye straight to base of caudal. Fins plain pale brownish. Eye brassy. Length  $1\frac{2}{3}$  inches.

Cope was entirely mistaken when stating that the inferior limb of the external branchial arches was without rakers.

**Hemigrammus schmardæ** (Steindachner).

Head 3; depth  $2\frac{1}{4}$ ; D. III, 9; A. IV, 21?; about 30? scales in a lateral count from gill-opening to caudal, including those on latter; snout  $4\frac{1}{2}$  in head, measured from tip of upper jaw; eye  $2\frac{1}{4}$ ; maxillary  $2\frac{1}{2}$ ; interorbital space 3. Color in alcohol brownish, scales fallen leaving a narrow silvery lateral band extending from shoulder to base of caudal. No blackish blotch at base of caudal, which while a little darker than rest of fin is not darker than peduncle. These conditions may all be due to the preservative. Length  $1\frac{1}{4}$  inches. A single small example in poor condition from the Peruvian Amazon. Coll. Prof. J. Orton.

**Hemigrammus interruptus** (Lütken).

*Hemigrammus luetkenii* Cope, Proc. Amer. Philos. Soc. Phila., XXXIII, 1894 (January 5), p. 91. In the Jacuhy (Brazilian province of Rio Grande do Sul). H. H. Smith.

The large series from the Jacuhy, Brazilian province of Rio Grande do Sul, and collected by H. H. Smith, shows: Head 3 to  $3\frac{1}{2}$ ; depth  $2\frac{1}{4}$  to  $2\frac{3}{4}$ ; D. III, 9; A. IV or V, 18, 1 to 22, 1, usually with 21, occasionally 22, sometimes 18, and rarely 20; scales 30 to 33 in lateral line to base of caudal, 2 or 3 more on latter, former count usually 33, frequently 32 or 31, and rarely 30; 11 or 12 scales in a transverse series obliquely back from origin of dorsal; 12 or 13 scales before dorsal; eye  $2\frac{1}{2}$  to 3 in head, measured from tip of upper jaw; length of specimens  $1\frac{1}{2}$  to 3 inches. Gill-rakers about 8 + 14.

**Hemigrammus robustulus** Cope. Fig. 24.

Proc. Amer. Philos. Soc. Phila., XI, 1869-70 (August 17, 1870), p. 561. Nos. 8,037 (type) to 8,052, A. N. S. P., cotypes. Pebas, Equador. John Hauxwell.—Cope, *l.c.*, XVII, 1877-78 (May 17, 1878), p. 690. Peruvian Amazon. Prof. J. Orton.

Body strongly compressed. Rami of mandible but little elevated inside mouth. Tongue rather flat, rounded, compressed and a little

free. Interorbital space rather broad and a little convex. Gill-opening extending forward to anterior margin of pupil. Rakers about a dozen? on lower outer limb of first arch. Filaments short. Isthmus narrow. Scales striate. Color in alcohol pale or dull brown, abdominal region and lower surface of head paler. Flanks also tinted with a livid grayish or dull slaty hue. A streak of slaty, diffuse and indistinct at first, extending along side of caudal peduncle and then continued out on median caudal rays as a blackish band. A dusky diffuse humeral blotch about size of orbit. Fins otherwise mostly uniform dull brownish. Muzzle deep brownish and front of mandible same.

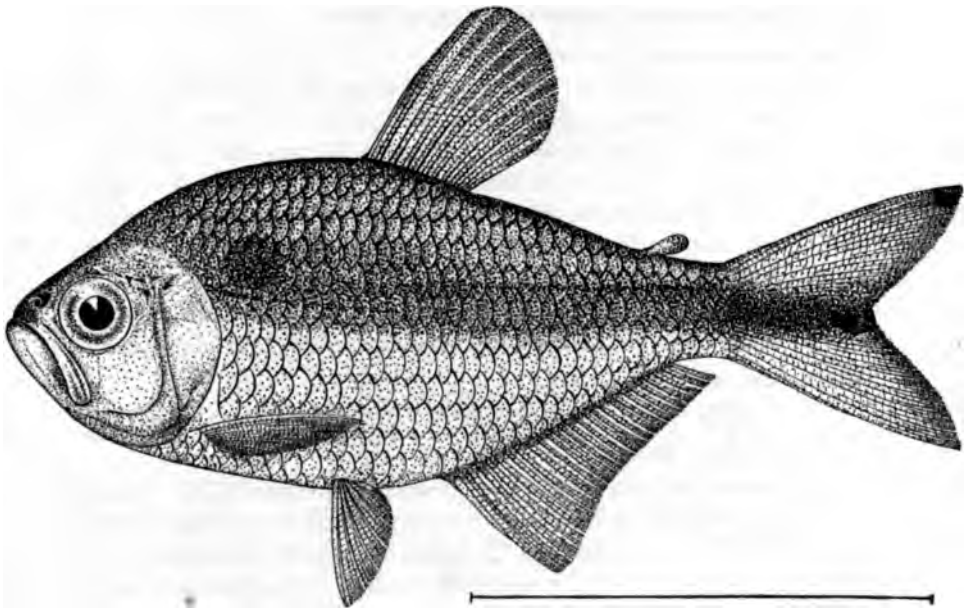


Fig. 24.—*Hemigrammus robustulus* Cope.

Spots or specks on cheek indistinct. Iris dusky-coppery. Length 2 inches (caudal damaged). Type.

The other cotypes range as follows: Head  $2\frac{2}{3}$  to  $3\frac{1}{2}$ ; depth 2 to  $2\frac{3}{4}$ ; D. II, 9; A. III, 23 to III, 29, 1; scales 27 to 32 (squamation mostly injured); total length  $1\frac{1}{2}$  to 2 inches.

Other examples in the Hauxwell Coll.

***Astyanax lepidurus* (Kner).**

*Tetragonopterus lepidurus* Cope, Proc. Amer. Philos. Soc. Phila., XI, 1869-70 (August 19, 1870), p. 566. Para. Mr. De Schulte Buckow.

Head  $3\frac{1}{4}$ ; depth  $3\frac{3}{4}$ ?; D. III, 9; A. III, 21?; scales (according to pockets)

about 33? in a lateral series to base of caudal; 9? scales between dorsal and ventral; snout 4 in head, measured from tip of upper jaw; eye  $2\frac{1}{2}$ ; maxillary  $2\frac{1}{2}$ ; interorbital space  $3\frac{1}{2}$ ; least depth of caudal peduncle 3. Maxillary toothless and extending posteriorly a little beyond front rim of orbit, not to pupil. Rakers  $10 + 16?$ , long, slender, and longest nearly as long as longest filaments. Scales large, mostly all fallen, and in alcohol leaving a narrow silvery band broadening out on posterior  $\frac{2}{3}$  of its course till about equal to diameter of pupil. No evidence of humeral or caudal blotches. Median caudal rays dusky, also tips of upper and lower lobes. Length  $1\frac{1}{2}$  inches. This example was received from Cope, and is most likely the one referred to above.

*Astyanax ipanquianus* (Cope). Fig. 25.

*Tetragonopterus ipanquianus* Cope, Proc. Amer. Philos. Soc. Phila., XVII, 1877-78 (May 4, 1878), p. 44. Nos. 21,114 (type) and 21,115, A. N. S. P., cotypes. The upper waters of the Urubamba, one of the sources of the Ucayale. Prof. J. Orton. Coll. of 1876-77.—Cope, *l.c.*, p. 692. Urubamba River; elevation 11,500 feet. Prof. J. Orton.

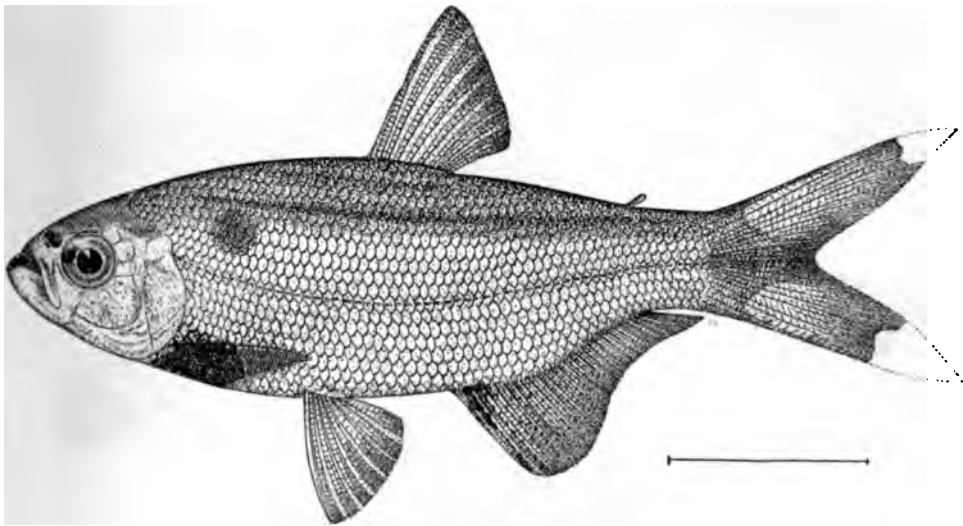


Fig. 25.—*Astyanax ipanquianus* (Cope).

Body compressed, and edges rounded. Snout convex. Rami of mandible not elevated inside mouth. Lips thin. Tongue fleshy, broad, rounded in front and hardly free from floor of mouth. Interorbital space convex. Gill-opening extending forward about opposite anterior nostril. Rakers  $9 + 11$ , lanceolate, short, and longest a little less than half length of longest filaments. Filaments  $\frac{1}{4}$  an eye-

diameter. Isthmus long and narrowly triangular. Each scale with a number of striae. Color in alcohol dull brassy-brown with silvery reflections, back slightly more brownish with a leaden tint. A humeral blotch of grayish about equal to orbit in size. Top of head brownish. Fins pale brownish, dorsal and caudal a trifle darker than others. Iris dull brassy-brown. Length (caudal slightly damaged) 5 inches. Type.

The other examples, including those later reported by Cope, show: Head  $3\frac{1}{4}$  to 4; depth 3 to  $3\frac{1}{4}$ ; D. II, 8; A. III or IV, 23, 1 to 27, 1; scales about 50? (squamation damaged) to 55 in lateral line to base of caudal, and 2 or 3 on latter; 23 to 25 scales before dorsal; 11 scales in an oblique series back from origin of dorsal to lateral line; 8 or 9 scales in a vertical series between lateral line and origin of anal; eye  $3\frac{1}{4}$  to 4 in head; total length  $2\frac{1}{4}$  to  $4\frac{1}{8}$  inches.

*Astyanax phœnicopterus* (Cope). Fig. 26.

*Tetragonopterus phœnicopterus* Cope, Proc. Acad. Nat. Sci. Phila., 1871 (1872), p. 261. Nos. 8,093 (type) to 8,128, A. N. S. P., cotypes. Ambyiacu River, Equador. John Hauxwell.

Gill-opening extending forward about opposite anterior margin of

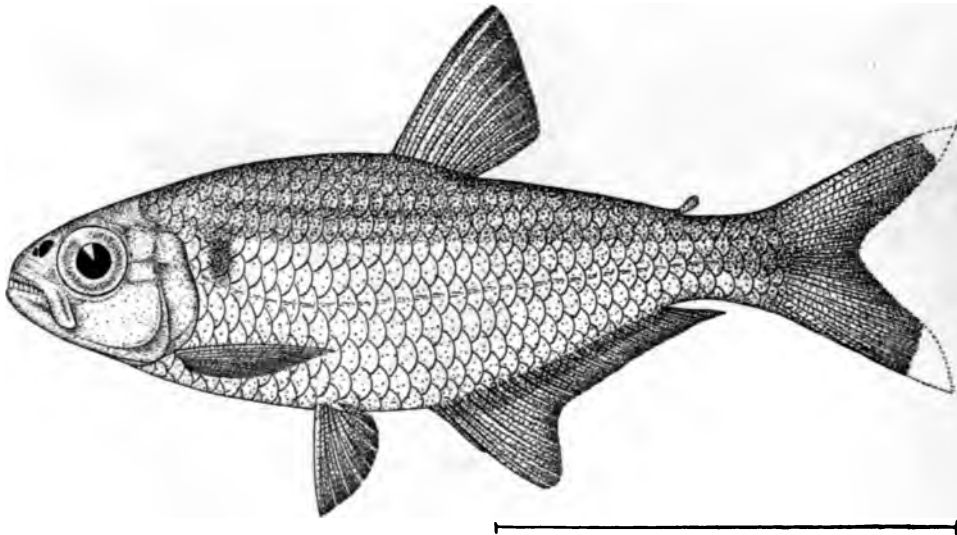


Fig. 26.—*Astyanax phœnicopterus* (Cope).

pupil. Rakers small and inconspicuous, about 7? on lower part of first arch. Filaments short. Isthmus compressed and narrow. Color in alcohol dull brown, more or less silvery. Side of head silvery.

Lower surface of body pale brown, and peritoneum showing through pale. A dusky humeral and caudal spot. Fins and iris pale brownish. Length (caudal damaged)  $2\frac{1}{4}$  inches. Type.

The other cotypes vary as follows: Head  $2\frac{1}{2}$  to 4, usually a little less than 4; depth 3 to  $3\frac{1}{4}$ ; D. III, 8, rarely III, 7; A. IV, 21 to 26, and frequently I, branched rays frequently 25; scales 30 to 35 (squamation damaged); total length  $1\frac{1}{2}$  to  $2\frac{1}{4}$  inches.

*Astyanax diaphanus* (Cope). Fig. 27.

*Tetragonopterus diaphanus* Cope, Proc. Amer. Philos. Soc. Phila., XVII, 1877-78 (May 17, 1878), p. 691. Nos. 21,216 (type) to 21,218, A. N. S. P., cotypes. Peruvian Amazon. Prof. J. Orton. Coll. of 1874.

Predorsal region with an obsolete median keel, and postdorsal region rounded. Preventral region rounded and postventral region trenchant. Rakers 7 + 10, slender, lanceolate, and longest a trifle more than longest filaments which are about equal to diameter of pupil. Isthmus narrowly triangular. Color in alcohol dull brownish, more or less brassy, and especially broad band from eye to base of caudal. Fins all dull brownish. Iris brownish-yellow. Length  $2\frac{1}{8}$  inches. Type.

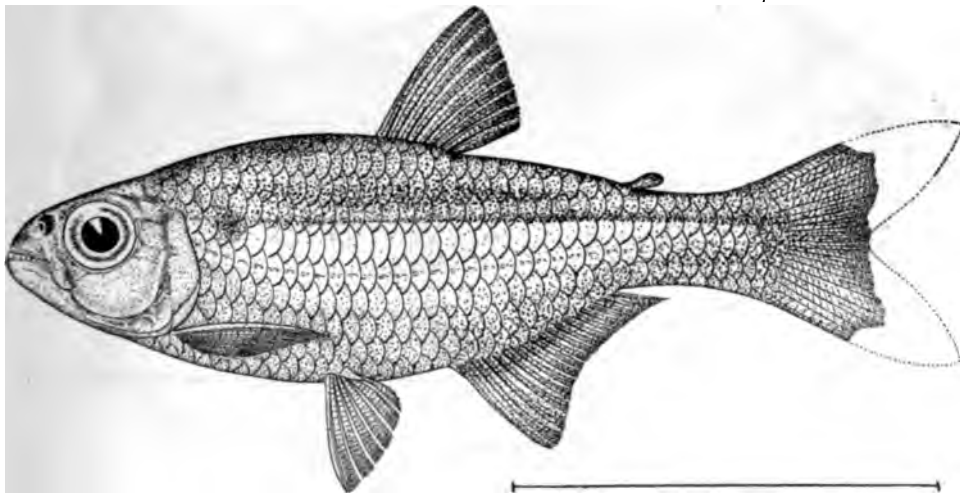


Fig. 27.—*Astyanax diaphanus* (Cope).

The other examples show: Head  $3\frac{1}{2}$  to 4; depth  $3\frac{1}{2}$  to  $3\frac{1}{4}$ ; D. II, 8; A. III, 17, I to 22, 1; scales 33 in lateral line to base of caudal and 3 more on latter; usually 4 scales in a vertical series between origin of anal and lateral line; eye  $2\frac{1}{2}$  to  $2\frac{3}{4}$  in head; length about 2 inches with damaged caudals.

*Astyanax huxwellianus* (Cope). Fig. 28.

*Tetragonopterus huxwellianus* Cope, Proc. Amer. Philos. Soc. Phila., XI, 1869-70 (August 19, 1870), p. 560: Nos. 8,137 (type) to 8,142, A. N. S. P., cotypes. Pebas, Ecuador. John Huxwell.—Cope, *Id.*, XVII, 1877-78 (May 17, 1878), p. 691. Peruvian Amazon. Prof. J. Orton. Coll. of 1873.

Gill-opening extending forward about opposite front of eye. Rakers 10? on lower part of first arch. Filaments a little longer than longest rakers. Isthmus compressed and narrow. Color in alcohol faded to dark brown, lower surface paler. Fins all brownish. A dusky blotch at base of caudal and a similar shade in humeral region. Iris brassy. Length  $2\frac{5}{8}$  inches (caudal damaged). Type.

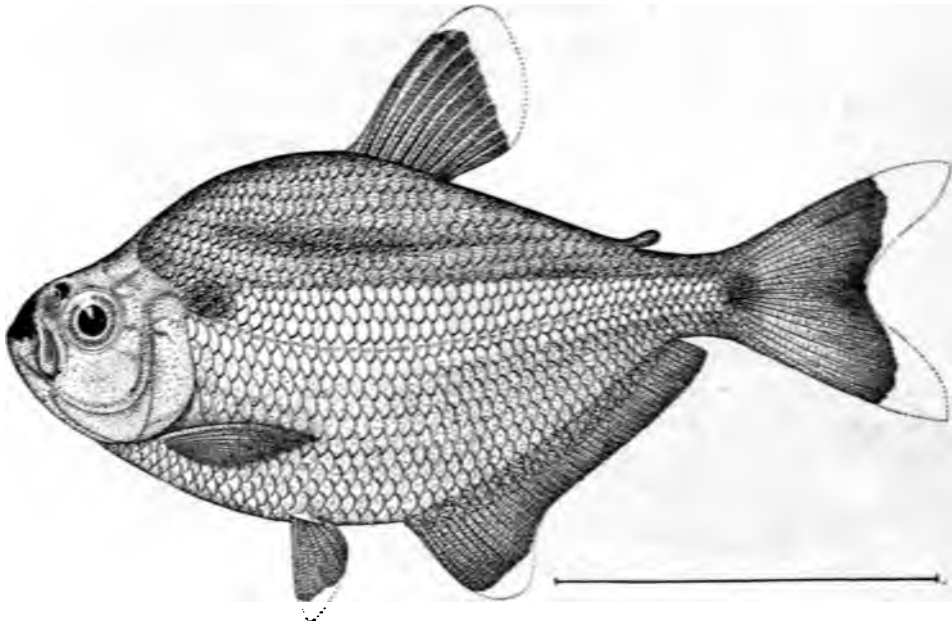


Fig. 28.—*Astyanax huxwellianus* (Cope).

The other cotypes show: Head  $3\frac{1}{2}$  to  $3\frac{3}{4}$ ; depth 2 to  $2\frac{3}{4}$ ; D. usually III, 9, sometimes III, 8 or III, 10; A. usually IV, 40?, sometimes IV, 41?; total length  $1\frac{1}{2}$  to  $2\frac{3}{4}$  inches. The distinct lateral silvery band mentioned by Cope is now hardly evident.

Also 59 examples from the Orton Coll. of 1873. Peruvian Amazon, and an example from Robert Perkins, from between the mouth of the Rio Negro and the Peruvian Amazon.



**Astyanax pectinatus** (Cope). Fig. 29.

*Tetragonopterus pectinatus* Cope, Proc. Amer. Philos. Soc. Phila., XI, 1869-70 (August 19, 1870), p. 560. No. 8,090, A. N. S. P., type. Pebas, Equador. John Hauxwell.

Gill-opening extending forward about anterior third of orbit. Rakers about 6 + 9, slender, lanceolate, and less than filaments which are about half of orbit. Isthmus narrow and compressed. Scales

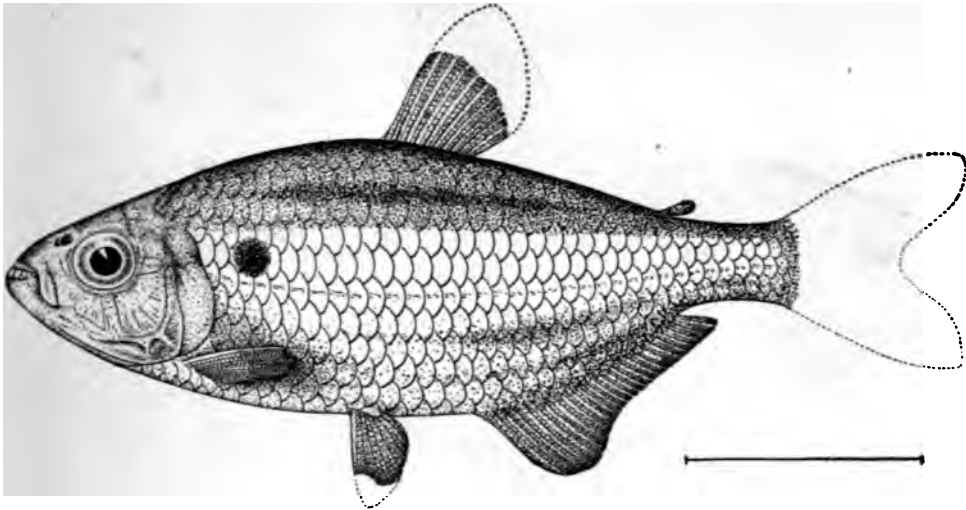


Fig. 29.—*Astyanax pectinatus* (Cope).

without striae. Color in alcohol with fins and body nearly uniform brownish, former paler. Body more or less washed with silvery. Iris brassy-brown. Traces of a humeral blotch, though indistinct. Length  $1\frac{1}{4}$  inches (caudal damaged).

**Astyanax longior** (Cope). Fig. 30.

*Tetragonopterus longior* Cope, Proc. Amer. Philos. Soc. Phila., XVII, 1877-78 (May 17, 1878), p. 691. Nos. 21,222 (type) and 21,223, A. N. S. P., cotypes. Moyabamba. Prof. J. Orton. Coll. 1874.

Predorsal region with a median obsolete keel and postventral region apparently trenchant, edges of body otherwise rounded. Gill-opening forward till about opposite front of eye. Rakers 9 + 11, lanceolate, and longest about  $\frac{3}{4}$  of filaments, which are  $\frac{5}{8}$  of orbit. Isthmus narrowly triangular. Each scale with several radiating striae. Color in alcohol faded dull brownish, and back darker than silvered sides. A broad silver line, separating color of back from that of lower surface, extending from shoulder to base of caudal. Humeral blotch rounded

and a little longer than pupil. Fins all brownish. Iris brownish with rosy tint. Length  $3\frac{3}{8}$  inches (caudal damaged). Type.

Cope's description would give the depth of the body  $4\frac{7}{10}$  in its length without the caudal, while in the above example it is but  $2\frac{7}{8}$ . The head is said to be  $4\frac{1}{8}$ , while the above example shows it about  $3\frac{3}{4}$ . He gives

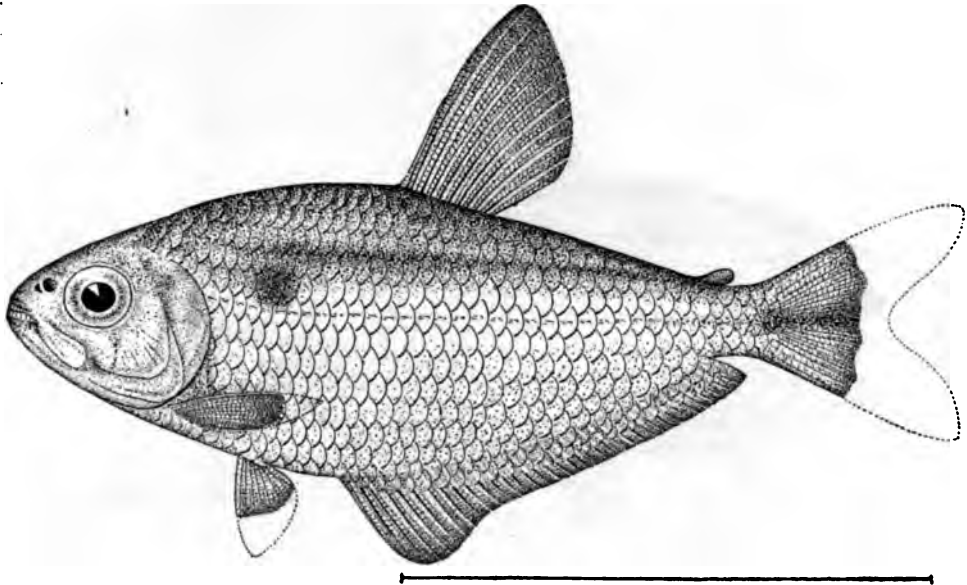


Fig. 30.—*Astyanax longior* (Cope).

the eye  $3\frac{1}{2}$  in the head, though the interorbital width is much less than  $1\frac{3}{10}$  in the eye, in fact but little less than the orbit itself. Both examples have Cope's original label.

***Astyanax maximus* (Steindachner).**

*Tetragonopterus* sp. *indel.* Cope, Proc. Amer. Philos. Soc. Phila., XVII, 1877-78 (May 17, 1878), p. 691. Peruvian Amazon. Prof. J. Orton. Coll. 1873.

Head  $3\frac{3}{4}$  to 4; depth  $2\frac{3}{8}$  to  $2\frac{1}{2}$ ; D. 1, 9; A. iv, 28, 1 to 29, 1; scales 34 to 35 in lateral line to base of caudal and 2? more on latter; 7 scales in an oblique series back between origin of dorsal and lateral line; 7 scales from base of ventral to lateral line; 7 or 8 scales in a vertical series between origin of anal and lateral line; 17 scales before dorsal; pectoral a trifle less than head; ventral  $1\frac{1}{2}$  to  $1\frac{1}{2}$ ; snout  $3\frac{1}{2}$  to 4 in head, from tip of upper jaw; eye about 3; interorbital space  $2\frac{3}{8}$ ; length of larger example with damaged caudal  $4\frac{3}{8}$  inches. Rakers 10 + 16, lanceolate, slender, longest but little shorter than filaments which are about  $\frac{3}{4}$

diameter of eye. Pectoral reaches well beyond base of anal. Color in alcohol nearly plain brassy-brown, back a little darker, and caudal with a brownish streak from base out to ends of median rays. No evidence of a humeral blotch.

***Astyanax caucanus* (Steindachner).**

Head  $3\frac{1}{2}$ ; depth  $2\frac{1}{2}$ ; D. II, 9; A. IV, 42; scales (according to pockets) about 38 in lateral line to base of caudal; pectoral about  $1\frac{1}{2}$  in head; ventral  $1\frac{1}{2}$ ; snout about  $4\frac{1}{2}$  in head, measured from tip of upper jaw; eye 3; maxillary 3; interorbital space  $2\frac{1}{2}$ ; least depth of caudal peduncle about 3. A few small teeth at base of maxillary inside. Rakers about  $7 + 12?$ , and longest about  $\frac{1}{2}$  of longest filaments. In alcohol brownish, fins paler than body-color, and a silvery band, widest on supracostal region, from shoulder to base of caudal where it terminates in a brownish spot. A brownish blotch on shoulder at origin of silvered lateral streak. Iris silvered brownish. Length  $2\frac{1}{8}$  inches. One example from Paramaribo. Dr. Hering.

***Astyanax bartlettii* (Günther). Fig. 31.**

*Tetragonopterus bartlettii* Cope, Proc. Acad. Nat. Sci. Phila., 1871 (1872), p. 260. Ambyiacu River, Equador. John Hauxwell.

Predorsal region with a median keel, rather obtuse, and postventral

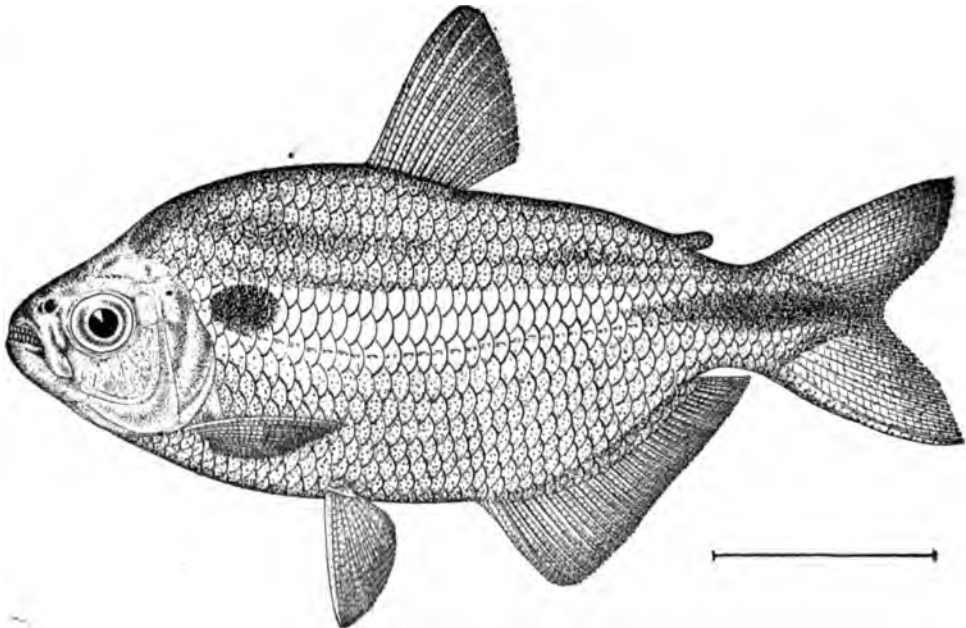


Fig. 31.—*Astyanax bartlettii* (Günther)

region but little trenchant, edges of body otherwise rounded. Gill-opening extending forward a trifle before front rim of pupil. Rakers about  $10 + 14$ , slender, lanceolate, longest about  $\frac{3}{4}$  of longest filaments and apparently rather weak. Filaments about  $\frac{3}{4}$  of orbit. A few striæ on each scale. Color in alcohol nearly uniform dull brownish, back a little darker and line of demarcation about level with upper margin of orbit distinct. A grayish elongate humeral blotch, most likely much faded, and in length nearly equal to diameter of eye. Base of caudal brownish and this color also extending out on median caudal rays. Fins otherwise all pale brownish. Iris brassy-brown. Length  $4\frac{1}{4}$  inches. Two examples.

*Bocourti*, 1868  
***Astyanax finitimus*** (Vaillant and Pellegrin). Fig. 32.

Predorsal region with a low median keel and one also on postventral, other edges of body rounded. Gill-opening not quite reaching front of orbit. Rakers  $8 + 13$ , lanceolate, longest about  $\frac{3}{4}$  of filaments and

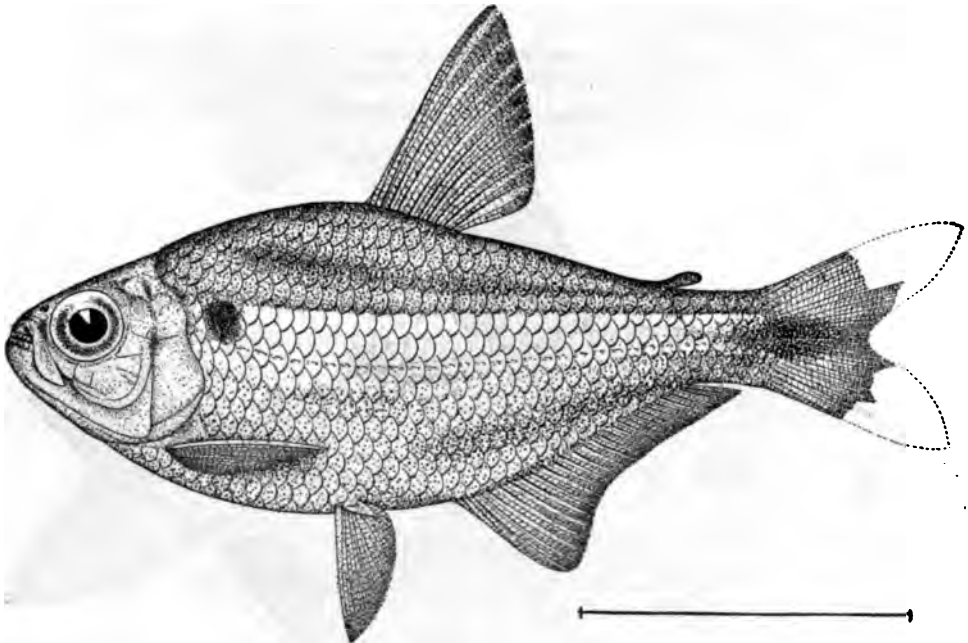


Fig. 32.—*Astyanax finitimus* (Vaillant and Pellegrin).

latter about  $\frac{3}{4}$  of orbit. Isthmus a little broadly triangular. Each scale with several radiating striæ. Color in alcohol brownish, back deeper and this color sharply separated from that of lower surface by a

broad silvery band from shoulder to caudal, where it becomes deep brown or dusky and extends out on median caudal rays. A dusky humeral blotch a little larger than pupil. Lower side and under portions of body silvered. Fins pale brownish, dorsal and caudal a trifle dusky. Iris brassy. Length  $2\frac{1}{8}$  inches (caudal damaged). Possibly from some part of Central America, most likely Nicaragua? Dr. J. F. Bransford. Five examples.

The others show: Head  $3\frac{1}{8}$  to  $3\frac{7}{8}$ ; depth  $2\frac{3}{4}$  to  $3\frac{1}{4}$ ; D. III, 9; A. III or IV, 24? to 26, 1; scales 36 in lateral line to base of caudal, and 2 more on latter; 8 scales obliquely back from origin of dorsal to lateral line; 8 scales in a vertical series between lateral line and origin of anal; eye  $2\frac{3}{8}$  to  $2\frac{1}{2}$  in head measured from tip of upper jaw; total length of specimens  $1\frac{7}{8}$  to  $3\frac{1}{2}$  inches (damaged caudals). The young examples are more elongate and have larger eyes in proportion, though at all ages the caudal and humeral blotches are evident.

Although the name *Tetragonopterus finitimus* was originally proposed by Bocourt (*Ann. Sci. Nat. Paris, Zool.*, 5, IX, 1868, p. 62), his account is entirely too brief and imperfect to permit identification. Prof. Vaillant and Dr. Pellegrin next describe examples from Guatemala which they identify with this species and which seem to agree with my own specimens.

**Astyanax mexicanus** (Filippi).

*Tetragonopterus mexicanus* Jordan and Snyder, Bull. U. S. Fish Comm., XIX, 1899 (1901), p. 125. Rio Ixtla at Puente de Ixtla, Morelos. Profs. D. S. Jordan and J. O. Snyder.

*Tetragonopterus streetsii* Cope, Proc. Acad. Nat. Sci. Phila., 1871 (November 28), p. 217. From the headwaters of the Coatzacoalcos River among the Cordilleras. Dr. T. Hale Streets.

*Tetragonopterus argentatus* Cope, Proc. Amer. Philos. Soc. Phila., XXII, 1885 (December 10, 1884), p. 168. In the city of Monterey. Prof. E. D. Cope. —Jordan and Snyder, *l.c.*, Rio Verde near Rascon. —Fowler, Proc. Acad. Nat. Sci. Phila., 1904 (April 7), p. 248. Del Rio and Devil's River, Texas. Dr. H. A. Pilsbry.

A very large series of examples of most all ages from Rio Ixtla at Puente de Ixtla, Morelos, and Rio Verde near Rascon, Mexico. These collected and presented by Profs. Jordan and Snyder. Also a large series from Monterey, Mexico, from Prof. E. D. Cope, and others from the same evidently from Mexico. Others from Del Rio and Devil's river, Texas, from Dr. H. A. Pilsbry. All show the following: Head 3 to 4; depth  $2\frac{1}{2}$  to  $3\frac{3}{4}$ ; D. III, 9, though sometimes II or III, 8, and rarely III, 10; A. III to IV, 17, 1 to 24, 1, usually 21 or 20, frequently 19 or 22, others with 23 and occasionally 24, though rarely 17 or 18; scales in lateral line to base of caudal 32 to 37, and 2 or 3 more on latter, usually 35, frequently 34 or 36, and rarely 32, 33 or 37; 7 or 8 scales in an oblique

series back from origin of dorsal to lateral line; 6 scales from base of ventral in a vertical series to lateral line, sometimes 7, rarely 5, and same between origin of anal and lateral line; 13 to 19 scales before dorsal, usually 15 to 16, less frequently 14 or 17, and rarely 13, 18 or 19; eye  $2\frac{1}{2}$  to  $3\frac{1}{2}$  in head, measured from tip of upper jaw, larger measurements in young; length of specimens  $1\frac{3}{8}$  to  $4\frac{3}{8}$  inches.

*Astyanax æneus* (Günther) is a closely related species differing chiefly in the absence of maxillary teeth, according to Dr. Meek's account. The other characters are seen to be more or less correlated, as several of my examples of *A. mexicanus* which possess as many as 24 developed or branched anal rays (would be 26 or 27 evidently according to Dr. Meek's count) also have well-developed basal maxillary teeth.

A number of examples, possibly cotypical of *Tetragonopterus streetsii* Cope, have uncertain data. They are included in the above measurements, and are Nos. 32,371 to 32,426, A. N. S. P.

***Astyanax fasciatus* (Cuvier).**

*Tetragonopterus fasciatus* Cope, Proc. Amer. Philos. Soc. Phila., XI, 1869-70 (August 19, 1870), p. 566. Para. Mr. De Schulte Buckow.

Head  $3\frac{1}{2}$ ; depth  $2\frac{3}{8}$ ; D. III, 9; A. IV, 26; scales 34 in lateral line to base of caudal, and 3 more on latter; 6 scales in an obliquely vertical series from origin of dorsal to lateral line; 6 scales in a nearly vertical series from origin of ventral to lateral line; 14 scales before dorsal; snout 4 in head, measured from tip of snout; eye 3; interorbital space  $2\frac{3}{4}$ ; least depth of caudal peduncle  $2\frac{1}{4}$ ; pectoral  $1\frac{1}{2}$  in head, from tip of mandible; ventral  $1\frac{3}{8}$ . Several minute maxillary teeth. Rakers about 9 + 15 on first arch, those on ceratobranchial largest, though shorter than filaments. Each scale of body with several striæ. Posterior distal extremity of maxillary extending back till opposite pupil. Humeral and caudal spots pale. Rather broad pale or silvery band on side of trunk evident. Iris brassy-brown and side of head silvery. Length  $2\frac{7}{8}$  inches. One example.

I accept the above name, as Dr. Günther pointed out the inconsistencies of Cuvier's figure and description, also when compared with other accounts. The examples identified by Prof. Ulrey (*Ann. N. Y. Acad. Sci.*, VIII, 1893-95, p. 284) as *Tetragonopterus fasciatus* (Cuvier), and credited to Dr. Eigenmann, with the developed anal rays 19 to 25, would seem to indicate a rather unusual range of variation.

***Astyanax eigenmanniorum* (Cope).**

*Tetragonopterus eigenmanniorum* Cope, Proc. Amer. Philos. Soc. Phila., XXXIII, 1894 (January 5), p. 89, Pl. 6, fig. 8. Nos. 21,598 (type) to 21,602, and 21,627 and 21,628, A. N. S. P., cotypes. Brazilian province of Rio Grande do Sul. H. H. Smith.

Predorsal region with median keel. Apparently a low keel on each

side of preventral region. Postventral region trenchant and edges of body otherwise rounded. Gill-opening extending forward a little beyond front margin of pupil. Rakers 8 + 10? (damaged), slender, pointed, and shorter than filaments. Isthmus narrow and compressed. A few striæ on each scale. Color in alcohol pale brownish, back darker than lower surface and traces of a pale or silvery band from eye to base of caudal. An indistinct brownish humeral blotch and another at base of caudal, also extending out on median rays of latter. Fins pale brownish. Eyes silvered. Length  $2\frac{2}{3}$  inches (caudal damaged). Type.

The other examples all show: Head  $3\frac{1}{2}$  to  $3\frac{1}{2}$ ; depth  $2\frac{2}{3}$  to  $2\frac{2}{3}$ ; D. III, 9, rarely II, 8; A. IV, 21, I or IV, 22, I, usually latter; scales 30 to 34 in lateral line to base of caudal and 2 or 3 on latter; 6 scales obliquely back from origin of dorsal to lateral line; 5 or 6 scales from origin of ventral to lateral line in a vertical series; 13 to 15 scales before dorsal, usually 14; eye  $2\frac{2}{3}$  to  $2\frac{2}{3}$  in head; total length of examples 2 to  $2\frac{1}{2}$  inches.

This form has been united with *Astyanax fasciatus* (Cuvier) by Prof. Ulrey. The above characters will show that it had at least best be regarded as distinct, if only provisionally. Further, it may be stated as differing principally from *A. fasciatus* in the fewer anal radii. All of the above characters are also constant, and it is possible to separate these specimens from those representing *Astyanax laticeps*, as Cope rightly determined. I shall therefore be obliged to remove the latter from the synonymy of *A. fasciatus*, where it has also been placed by Prof. Ulrey, as it differs principally in still fewer anal radii. Thus from an examination of the material before me I shall refuse to consider *A. eigenmanniorum* and *A. laticeps* either as variations of *A. fasciatus* or in fact either as the same species. Finally Cope's description and figure of *A. eigenmanniorum* may hardly be styled excellent, much less that it leaves little doubt that the fish in question is simply a variation of *T. fasciatus*.

*Astyanax iheringii* (Boulenger).

*Tetragonopterus pliodus* Cope, Proc. Amer. Philos. Soc. Phila., XXXIII, 1894 (January 5), p. 90, Pl. 5, fig. 5. Nos. 21,578 (type) and 21,579, A. N. S. P., cotypes. Brazilian province of Rio Grande do Sul. H. H. Smith.

Predorsal region with median rounded ridge, and postventral trenchant, edges of body otherwise rounded. Gill-opening reaching front of pupil. Rakers about 10 + 12, short, lanceolate, and longest about  $\frac{1}{2}$  of longest filaments which are about equal to  $\frac{1}{2}$  of vertical orbital diameter. Isthmus triangular and rather broad. Each scale with several radiating striæ. Color in alcohol brownish, lower portion of

body, from level with upper edge of eye, silvery. A lateral silvered streak from eye to caudal. Traces of a faint humeral and caudal blotch. Dorsal and posterior edge of caudal brownish. Iris dull orange. Length  $2\frac{1}{8}$  inches. Type of *Tetragonopterus pliodus* Cope.

An example labelled Montevideo, Uruguay, received from Cope.

Cope was evidently in error in stating that the humeral and caudal spots were wanting, as even now the former is present though indistinct, and the median caudal rays are darker than the rest of the caudal fin. There is also a dull brownish shade at the base of the caudal. Outer portions of dorsal, caudal and anal brownish; not exactly "finely specked with black" as stated by Dr. Boulenger.

***Astyanax laticeps* (Cope).**

*Tetragonopterus laticeps* Cope, Proc. Amer. Philos. Soc. Phila., XXXIII, 1894 (January 5), p. 89, Pl. 6, fig. 7. Nos. 21,852 (type) to 21,863 and 21,743 to 21,747, A. N. S. P., cotypes. Brazilian province of Rio Grande do Sul. H. H. Smith.

Predorsal region with a median keel and postdorsal with an obsolete median ridge with one on each side. Preventral region apparently rounded. Postventral region with median keel. Gill-opening extending a little before front of pupil. Rakers 9 + 12, slender, pointed, and a little less than longest filaments. Isthmus narrow and compressed. Color in alcohol pale brownish, back darker than sides and lower surface, and a silvery band from shoulder to base of caudal, its width less than orbit. Body, especially lower surface and side of head, more or less silvered. A rounded dusky humeral blotch, and a dusky dash at base of caudal continued out on median rays of latter. Fins plain pale brownish. Iris brassy with a plain pale brownish ring. Length  $2\frac{1}{8}$  inches (caudal damaged). Type.

The other examples show: Head  $2\frac{1}{2}$  to  $3\frac{1}{2}$ ; depth  $2\frac{1}{2}$  to 3; D. III, 9; A. IV, 18, 1, rarely IV, 19, 1; scales 30 to 35 in lateral line to base of caudal, and usually 3 or 4 more on latter; 14 to 16 scales before dorsal, usually 15; 6 to 8 scales in an oblique series back from origin of dorsal to lateral line, usually 7; 6 or 7 scales from origin of ventral to lateral line, usually 6; eye 3 to  $3\frac{1}{2}$  in head, from tip of upper jaw, usually but little over 3; total length  $1\frac{1}{2}$  to  $2\frac{1}{2}$  inches.

This species has been united with *Astyanax fasciatus* (Cuvier) by Prof. Ulrey (*Ann. N. Y. Acad. Sci.*, VIII, 1893-95, p. 283). *A. laticeps* has three distinct small denticles at the base of the maxillary.

***Astyanax lineatus* (Perugia).**

*Tetragonopterus lineatus* Cope, Proc. Amer. Philos. Soc. Phila., XXXIII, 1894 (January 5), p. 107. Near Chapada in Matto Grosso from the headwaters of the Paraguay. H. H. Smith.

Head  $3\frac{1}{2}$ ; depth  $2\frac{1}{2}$ ; D. III, 9; A. IV, 25, 1; scales 33 in lateral line to



base of caudal, and 3 more on latter; 7 scales in an oblique series back from origin of dorsal to lateral line; 6 scales in a vertical series from base of ventral to lateral line, and same number from origin of anal to latter; about 15 scales before dorsal; pectoral  $1\frac{1}{2}$  in head; ventral  $1\frac{1}{2}$ ; lower caudal lobe 1; snout  $3\frac{1}{2}$  in head, measured from tip of upper jaw; eye 3; interorbital space  $2\frac{1}{2}$ ; least depth of caudal peduncle  $2\frac{1}{2}$ . At least one small denticle at base of maxillary. Posterior distal extremity of maxillary extending till opposite anterior margin of pupil. Rakers about 9 + 15, slender, pointed and longest much shorter than filaments. In alcohol with a pale dusky humeral blotch. A dash of dusky on middle of side of caudal peduncle at base of caudal, fading out over posterior portion of anal, though posterior it extends out on middle caudal rays. About ten distinct longitudinal brownish lines on body, darker on back, and made up of dark brownish specks or dots. Iris brownish with a darker brownish ring. Length  $3\frac{1}{2}$  inches.

Dr. Steindachner's figure in *Sitz. Ak. Wiss. Wien*, C, 1891, p. 368, Pl. 2, fig. 1, does not show the dusky streak on the side of the caudal peduncle.

*Astyanax chapadms* sp. nov. Fig. 33.

Head  $3\frac{1}{2}$ ; depth 3; D. III, 8; A. IV, 18; P. I, 9; V. I, 7; scales 39 in lateral line to base of caudal, and 3 more on latter; 6 scales from origin of dorsal obliquely back to lateral line, and 4 in same way from origin of adipose fin; 4 scales between origin of ventral and lateral line obliquely forward; 4 scales between origin of anal and lateral line; 16 scales before dorsal; width of head  $1\frac{1}{2}$  in its length; depth of head, over middle of orbit,  $1\frac{1}{2}$ ; snout  $3\frac{1}{2}$ ; eye 3; maxillary  $2\frac{1}{2}$ ; interorbital space 3; mandible  $2\frac{1}{2}$ ; length of depressed dorsal  $1\frac{1}{2}$ ; pectoral  $1\frac{1}{2}$ ; ventral 2; upper caudal lobe  $1\frac{1}{2}$ ; least depth of caudal peduncle  $2\frac{1}{2}$ .

Body elongate, compressed, rather ovoid, lower profile a little more convex than upper, and greatest depth at origin of dorsal. Predorsal region rounded. Postdorsal region with a median obtuse keel. Pre-ventral region rounded. Postventral region slightly trenchant. Caudal peduncle compressed, and its least depth about  $\frac{2}{3}$  its length.

Head a little long, somewhat attenuated, well compressed, muzzle a little pointed, upper profile a little concave above eye posteriorly, and lower profile rather evenly convex. Snout a little long, convex, and produced a little beyond tip of mandible. Eye circular, a little superior and its center about first  $\frac{2}{3}$  in head. Mouth a little oblique. Maxillary obliquely vertical, its distal expanded extremity reaching about opposite front margin of pupil and its width about half of diameter of same. Mandible strong. Lips rather fleshy. Teeth in jaws mostly

quindentate, especially those in mandible anteriorly which are also long and pointed, and five in each outer series above. At least three small serrated teeth along base of maxillary. Tongue elongate, fleshy and not free. Nostrils together near upper front rim of orbit. Interorbital space a little convex. Greatest width of infraorbital rim a little less than orbit or much broader than greatest exposed width of opercle.

Gill-opening extending forward opposite front margin of pupil. Rakers about  $7 + 10$ , lanceolate, rather far apart, and longest about  $\frac{2}{3}$  of longest filaments. Filaments about equal to pupil. Isthmus narrow. Branchiostegals 4.

Scales large, well striated, largest on flanks, and in longitudinal

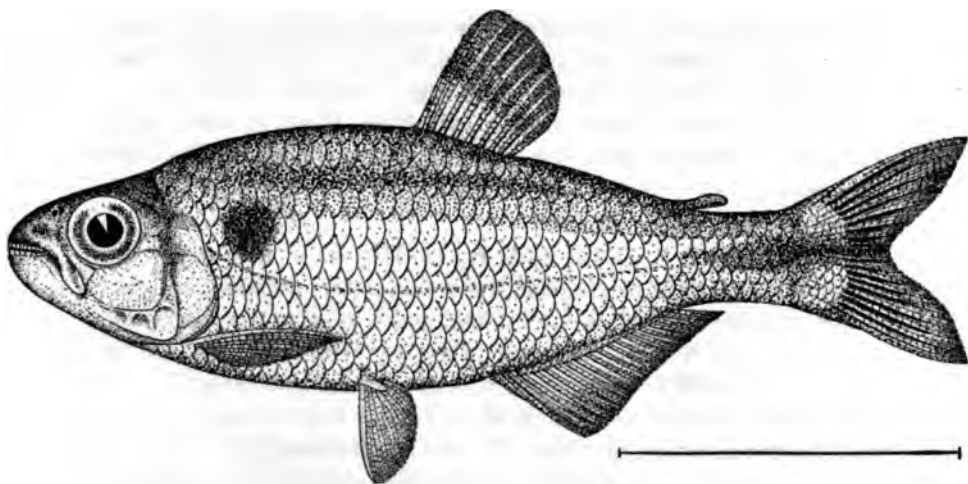


Fig. 33.—*Astyanax chapadæ* Fowler.

series parallel with lateral line. Basal anal sheath low and of small scales. Base of caudal well covered with small scales. Axillary ventral scale about  $\frac{1}{3}$  length of fin. Lateral line well decurved and running rather low posteriorly to base of caudal. Tubes simple.

Origin of dorsal a little nearer base of caudal than tip of snout, fin low, and when depressed reaching  $\frac{2}{3}$  of space to base of caudal. Adipose fin small, its origin near last third in space between origin of dorsal and base of caudal, or just behind base of last anal ray, and length of fin less than orbit. Origin of anal about opposite base of penultimate dorsal ray, or about midway between that of pectoral and base of caudal. Caudal rather small, emarginate, and lobes rounded. Pectoral falling a little short of ventral. Ventral

inserted nearly midway between tip of snout and tip of last anal ray, or well before dorsal, and reaching about  $\frac{3}{4}$  of space to anal. Vent close in front of anal.

Color in alcohol brown, especially back, sides and lower surface silvered and pale. A humeral blotch. A faint trace of a slightly lighter silvered band from shoulder to base of caudal, posteriorly becoming plumbeous though only slightly dusky at base of caudal, and same shade also continued out on median caudal rays to their tips. Base of each caudal lobe with a pale straw-colored blotch about size of pupil, then membranes between rays blackish and fading out into pale dusky posteriorly. Dorsal brownish with an indistinct dusky cross-streak. Other fins all pale and unmarked. Iris brownish.

Length  $2\frac{1}{4}$  inches.

Type, No. 21,828, A. N. S. P. Near Santa Anna da Chapada, in Matto Grosso, Brazil, from the headwaters of the Paraguay. August, 1884. H. H. Smith. Prof. E. D. Cope. Also paratype, No. 21,829, A. N. S. P., with same data.

This species is closely related to *Astyanax moenkhausii* (Eigenmann and Kennedy), from which it differs chiefly in the coloration. *A. paucidens* (Ulrey) and *A. jenynsii* (Steindachner) both differ in the fewer scales, apparently not more than 33.

(Named for Santa Anna da Chapada, province of Matto Grosso, Brazil.)

# DESCRIPTIONS OF TWO NEW POLYCHÆTA FROM ALASKA.

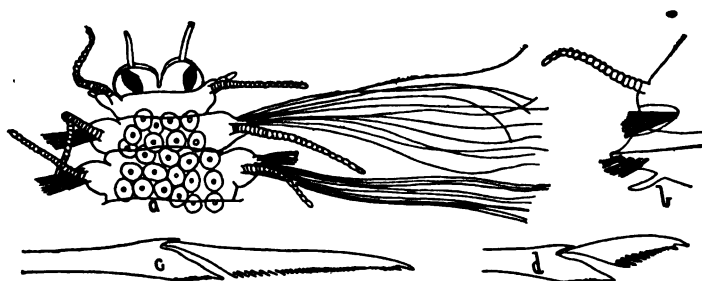
BY J. PERCY MOORE.

Among a number of Alaskan Polychæta in the collections of this Academy, the two of which the descriptions follow are new.

## *Syllis quaternaria* sp. nov.

This sexual free-swimming form of the type for which Malmgren instituted his genus *Chætosyllis* is probably the epitokous form of a true *Syllis*, but it cannot be correlated with any atokous form hitherto described.

The length varies from 7 to 9 mm.; the width between the ends of the parapodia is .8 mm. and between the tips of the capillary setæ 4.5 mm., or one-half the length of the body.



*Syllis quaternaria*.—*a*, dorsal view of prostomium, peristomium and first two somites bearing capillary setæ,  $\times 24$ ; *b*, parapodium from IX with setæ cut off,  $\times 32$ ; *c*, a long and *d*, a short notopodial seta from X,  $\times 600$ .

The prostomium (*a*) consists of a pair of prominent hemispherical lobes separated by a deep, narrow, median cleft, and each again divided by a shallow transverse groove. A pair of simple unjointed or obscurely wrinkled cylindrical tentacles arise from the latter grooves and incline decidedly toward the dorsum. They reach a length of  $1\frac{1}{4}$  to  $1\frac{1}{2}$  times the prostomium. No other cephalic appendages exist, but there are two pairs of dense, black or deep brown, short spindle-shaped eyes, each provided with a small cuticular lens. The dorsal eyes are the more posterior and look vertically upwards; the large ventral pair look downwards, forwards and outwards. Sometimes 1 or 2 small, rod-like

bodies of pigment occur with the eyes. The mouth is a minute opening situated at the very bottom of the vertical prostomial cleft near the ventral surface.

The peristomium (*a*) is but little modified and a segment just like the others, except that the parapodia lack the capillary setæ. The sides of the body are nearly parallel almost to the caudal end, where the last 12 to 15 of the total number of 40 to 43 segments taper to the pygidium. Each segment is about  $\frac{1}{2}$  as long as wide, or anteriorly rather more than this. The small triangular pygidium bears a pair of large, stout moniliform cirri of about 25 joints, and in the males an additional short, slender, and unjointed median ventral cirrus.

Excepting the first pair the parapodia (*b*) are biramous, and all but the first and the last few bear capillary setæ in the notopodium. The basal part is a rather large dome-shaped structure, from which the neuropodium projects rather prominently and ends in a short, slightly curved dorsal acicular process, while a postsetal lamina, stepped at the ends for the rows of setæ, forms its more ventral portion. Two or three straight aciculi support the neuropodium. From the middle of the ventral surface of the foot arises a short, slender, tapered and unjointed ventral cirrus. The notopodium is a very slight, conical tubercle which receives the end of a single aciculum strongly curved at the tip and caps a large yellowish setigerous sac, from which the capillary setæ spring. Well above and separated from this tubercle arises the dorsal cirrus, which is always prominent and strongly moniliform. With considerable regularity the dorsal cirri are alternately longer and shorter, the even numbers being about equal to  $\frac{3}{4}$  of the width of the body exclusive of the parapodia and consisting of 20 to 25 joints, whereas the odd numbers are about  $\frac{3}{4}$  as long as they and have only 14 to 16 joints.

As stated above, all but the peristomium and the last 5 or 6 segments bear capillary notopodial setæ which form dense and very conspicuous bundles. They are perfectly smooth and simple in structure, glass-like in appearance, tapered to excessively fine but apparently flattened ends, and are more or less curved and sometimes curled and twisted at the ends—the latter condition being probably the result of preservation.

Neuropodial setæ are arranged in 5 or 6 horizontal sub-acicular rows. They are relatively short and stout and perfectly colorless and vitreous. The curved stems are deeply cupped, and toothed along the more prolonged side. The blades end in a single, rather stout, little hooked tooth, and the dorsal or shorter side is provided with a moderately

strong fringe best developed on the shorter blades, which also exhibit an aggregation of some of the terminal hairs to simulate an accessory tooth. On the ventral setæ the blades seldom exceed a length of twice the diameter of the end of the shaft, while those of the 3 or 4 setæ in the dorsalmost row are narrower and 4 or 5 times as long as the distal end of the shaft.

Although all of the specimens examined are fully mature and have the body cavity filled with ova or sperm, the alimentary canal is complete and well developed, extending continuously from mouth to anus without exhibiting any of that occlusion or degeneration seen in many sexually mature syllids and other annelids.

The type and about a score of cotypes are No. 1,091 of the Academy's collections. Taken on the "surface in a lead 4 miles from shore by Mr. E. A. McIlhenny at Point Barrow, Alaska."

*Ammotrypane brevis* sp. nov.

The type of this species is a somewhat contracted specimen 15 mm. long, 1.5 mm. broad and 1.9 mm. high in the middle, being therefore rather robust and tapering to both ends. The general resemblance to *A. aulogaster* is close, but if the differences exhibited by the single specimen prove to be constant the two species are readily separated.



*Ammotrypane brevis*.—Parapodium and gill from somite X,  $\times 56$ .

Instead of being laterally compressed the prostomium is blunt and flattened dorso-ventrally. From it a slight median ridge passes backward and gradually merges into the dorsal curvature of the back. Below this ridge on each side are the small sensory pits or nuchal organs. The mouth is a small trifold opening bounded by a pair of small anterior lobes and a single posterior lobe. Although the body seems to be quite complete and exhibits no indications of regeneration, there are only 29 setigerous somites not distinguishable from one another externally except through the presence of the parapodia. No intersegmental furrows whatever are discernible and the segments pass continuously into one another. Ventrally a pair of stout muscular bands, separated by a deep median groove, produce a somewhat sole-like surface. Above this the body is narrower and strongly arched

and marked only by the small transverse muscle bundles, apparently 4 to each segment.

If perfect, as it appears to be, the pygidium presents striking characteristics. The large median spoon-shaped lobe of *A. aulogaster* is absent and represented only by a minute slender process. The lateral lobes are much larger, obliquely truncated above, and slightly indented at the end.

The parapodia arise from the dorso-lateral surface of the lateral muscle bands and are about equally well developed throughout. They form small but distinct bluntly rounded tubercles produced into a small, conical prominence and apparently unsupported by an aciculum. They bear only a small ventral cirrus and a prominent dorsal branchia, the small dorsal cirrus which has been figured for some species being absent. Branchiæ are absent from the first pair of parapodia, but are present on all of the others. They are largest on the middle segments, where they exceed a millimeter in length and the parapodium in diameter. They are slender and slightly tapering in form and provided along one side with a strongly developed longitudinal muscle, rendering them very contractile.

The setæ are all simple, colorless, tapering, capillary bristles, longitudinally fibrillated and soft in texture. They are arranged in two fascicles, a dorsal of 6 to 10 setæ which reach  $\frac{3}{4}$  the length of the branchia, from the base of which they arise, and a ventral which arises from beneath the conical prolongation of the parapodium and contains 5 or 6 setæ less than  $\frac{1}{2}$  as long as the dorsal bristles.

Along the sides of the body between the parapodia, but nearest to the succeeding one, are small black or dark brown and very conspicuous eye spots, which are hemispherical in shape and indistinctly faceted on the surface.

The only specimen, a female filled with eggs, is No. 284 of the Academy's collection, taken by Dr. Benjamin Sharp at Icy Cape, Alaska, on August 17, 1895.

## NOTE ON THE DUSKY SALAMANDER.

BY HENRY W. FOWLER.

Near Port Allegany, in McKean county, and in the valleys of the headwaters of the Genesee, Allegheny and Susquehanna, in Potter county, Pa., Mr. T. D. Keim and the writer spent a few days, studying the fauna, in the summers of 1904 and 1906. Most of the hemlock forests have been cleared off, except near Port Allegany, where one still has but a short time left to study the animal life in its primeval conditions.

Perhaps the most abundant in individuals among cold-blooded vertebrates was the little dusky salamander, *Desmognathus fusca*. It was found nearly everywhere in the valleys, about and in streams, and on the comparatively dry mountain-tops, though there less numerous and more solitary. About the headwaters of the Genesee they were even more abundant, so that we had the opportunity of examining multitudes of living examples. So abundant were they in some localities that as many as four or five would frequently occur under a single small stone. Owing to the nature of the brooks about the Genesee headwaters, which are very swift, cold and sinking out of sight in some places to appear again in others, very favorable habitats are secured in the comparatively damp intercourses which are only flooded in times of heavy rains.

Very great range in color-pattern and color-variation was noted in this species. Young an inch long had the pale area on the back more or less immaculate pink or pale brown. The uppermost of the accompanying figures, Plate XIII, indicates this type. They varied from these shades into the dusky-black adults. They did not always appear to change from pinkish to brown, as some with pink backs were found equally as large as the larger brownish ones. The pale colors of the back were not always immaculate, many being variously blotched or speckled with darker or brownish. Very dark or blackish examples, not larger than the largest pink or brown ones, also occurred, though these all showed traces to some extent of the dorsal color-pattern. Most all full-grown examples lose every trace of the dorsal color-pattern in the blackish of the back.



A comparison of the types of *Desmognathus ochrophæa* Cope seems to leave it perfectly clear that it is nothing more than the intermediate brown color-variety of *D. fusca*, which I have represented in the two lower median accompanying figures. The identity of *D. ochrophæa* with *D. fusca*, however, was first suggested by Mr. G. M. Allen in the *Proc. Bost. Soc. N. H.*, 29, 1901, p. 73. In view of the material examined I am now able to fully endorse Mr. Allen's view as final. The characters pointed out by Cope in 1889 are certainly not of specific value as they range more or less through most of my material. The habitat of the *ochrophæa* stage is not confined entirely to the mountain-tops, as the animals are found under damp stones about streams and in the valleys. I do not agree with Cope's suggestion that *Salamandra haldemani* Holbrook is "an unusually spotted *Spelerpes bilineatus*" as the tail is somewhat short. It agrees with some of my examples of *D. fusca* to some extent in the color of the belly, which is usually more or less livid in life. It had best be regarded as a synonym of *D. fusca*.

As small and medium-sized examples greatly resemble *Plethodon erythronotus*, which is rather abundant in the dry forests, a good character for distinguishing the two species at a glance will be found in the pale or whitish streak extending down from the eye behind. This is present on most all examples and may frequently be traced to some extent in the blackish adults.

**A CONTRIBUTION TO THE KNOWLEDGE OF THE ORTHOPTERA OF MONTANA,  
YELLOWSTONE PARK, UTAH AND COLORADO.**

BY JAMES A. G. REHN AND MORGAN HEBARD.

During the month of August, 1904, the junior author was occupied in collecting Orthoptera at a number of localities extending from eastern Montana to Salt Lake City, and from that locality to east-central Colorado. Collecting at some localities was limited to a few minutes search permitted by the stoppage of the train, at other localities several days were spent and very extensive and interesting collections made. The careful study of the Orthoptera of the Yellowstone Park and of Pike's Peak yielded some interesting and scarce species, as well as two new forms and a considerable amount of information on the habitat and actions of a number of species.

The number of specimens in the collection studied is about 2,800, and 121 species are represented. Notes on the habits and other information has been given under most of the species by the collector, and the chief localities visited have been briefly described, to aid in a proper understanding of their conditions and environmental features as well as to aid future students in this region.

A considerable representation of the species treated in this paper has been placed in the Academy's collection by the junior author.

MONTANA.

*Waco, Yellowstone Co.*, elevation 2,700 feet. On the sage-brush plains just east of the foothills of the Rockies.

*Grey Cliff, Sweetgrass Co.*, elevation 3,900 feet. In a more rugged character of country than Waco but with a similar vegetation. Orthoptera appeared to swarm as the specimens collected were taken in less than two minutes.

*Billings, Yellowstone Co.*, elevation 3,115 feet. Specimens taken here were from the dusty main street of the town.

*Livingston, Park Co.*, elevation 4,488 feet. Material from this locality was taken among weeds growing in a vacant lot near the station.

*Emigrant, Daileys, Sphinx and Electric, Park Co.*, elevation 4,800-

5,100 feet. During the brief stops made by the train between Livingston and Gardiner a little collecting was possible. These stations are situated in the valley of the Yellowstone river between the Snowy Mountains and the Gallatin Range. The vegetation is chiefly sage-brush and other plants which grow in a semi-arid soil. Orthoptera were very plentiful, and had time allowed a great quantity could easily have been taken.

*Muir, Bozeman Tunnel, Park Co.*, elevation 5,496 feet. At this point a few minutes' stop afforded an opportunity to collect in the heavy growth of weeds and grasses along the track. The vegetation was very luxuriant and wholly different from that found in the semi-arid sections. The Orthoptera of regions of this character was always much less abundant than in the sage-brush country.

*Three Forks, Willow Creek and Sappington, Gallatin Co., and Jefferson City and Whitehall, Jefferson Co.*, elevation 4,061-4,529 feet. During the brief stops made at these towns a few specimens were taken. The soil was barren and Orthoptera was far less plentiful than in the more eastern portion of the State.

*Spire Rock, Jefferson Co.*, elevation 5,217 feet. Among the great boulders on the summit of the mountains near Butte a few specimens were seen and hardly any vegetation found. This locality was by far the most desolate of any at which collecting was done.

#### YELLOWSTONE PARK.

*Mammoth Hot Springs*, elevation 6,215-7,000 feet. At Fort Yellowstone, where the Mammoth Hot Springs are situated, a great variety of collecting grounds are within easy reach. About the fort itself, among the weeds and grasses, Orthoptera were not very plentiful; but immediately behind the hotel, in the dense sage-brush growing on the sides of the foothills, vast quantities of Orthoptera of many species were to be found. Collecting here was somewhat difficult owing to the steep hillside and the agility of the majority of the species, as well as the difficulty of following more interesting specimens on account of the quantities of more common species which everywhere swarmed. At a greater elevation on the sides of these hills the sage-brush gave place somewhat to grasses and other low growing plants, where Orthoptera were less prevalent but more desirable. On the summits, however, the ground was pebbly and overgrown with sparse and stunted grasses, in which situations many most desirable species were abundant and could be easily taken in the scanty vegetation. In one grassy hollow near the top of the foothills, among scattered bushes near a thicket

of aspen, I found species which did not seem present in the surrounding sections, among which were *Hippiscus maculatus*, *Circotettix rabula*, *Bradynotes obesa* and *Melanoplus alpinus*.

At the head of the hot springs I found a plot of marsh grass among the stunted pines which revealed several species of crickets and other Orthopterous insects not found in the surrounding country. On the summits of the higher foothills nearby an even greater variety of the more interesting forms were found.

*Apollinaris Spring*, elevation 7,250 feet. Material collected here was from dense pine woods.

*Fountain, Lower Geyser Basin*, elevation 7,230 feet. Very few specimens could be found here, the pine woods nearby revealing nothing whatever, while but very few individuals were taken on the geyser formation and in the short grass near the hotel. This was the most unfavorable locality found in the Park.

*Old Faithful Inn, Upper Geyser Basin*, elevation 7,830 feet. Here two distinct collecting localities were accessible in which few though interesting forms were found. Between Old Faithful geyser and the Firehole river a space of short grass contained numerous *Arphia pseudonietana*, while on the surrounding geyser formations the same species could be found in very small numbers. Back of the Inn, among the short but thickly-growing pines, several species of *Melanoplus* (*M. bruneri* and *fasciatus*) were found which were not met with elsewhere in the Park. Unlike most of the Yellowstone localities, long and diligent search was required to secure each specimen.

*Norris Pass, Continental Divide*, elevation 8,240–8,320 feet. About the Norris Pass the vegetation was scanty owing to the elevation. In the more open spaces a short grass grew plentifully and several species of Orthoptera could have been taken in numbers had time permitted.

*The Thumb, Yellowstone Lake*. About The Thumb on the shore of Yellowstone Lake the vegetation was heavy, but owing to the few cleared spaces but few Orthoptera were found.

*Exit of the Yellowstone River*, elevation 7,742 feet. At this point above the high abrupt bank on the left side is a large treeless expanse covered by high plants and shrubs. In this location all forms of insect life were very plentiful, and many varieties of boreal Lepidoptera were noticed. The Orthoptera of this section differed materially from that found in the more arid geyser regions.

*Mud Volcano*, elevation 7,740 feet. Collecting here was done on sandy soil.

*Near Grand Cañon*, elevation 8,000 feet. The country about the

Grand Cañon much resembled that about Yellowstone Lake, but Orthoptera were less abundant. As in other parts of the Park, very few specimens could be found in the woods.

#### UTAH.

*Vicinity of Salt Lake City, Salt Lake Co.*, elevation 4,230–6,000 feet. About Salt Lake City I found the vicinity of Ensign Peak (top 6,000 feet elevation) by far the most productive collecting ground. There the soil was dry and gravelly, but covered with a somewhat sturdy growth of sage-brush and other desert plants. In this place Orthoptera swarmed and great difficulty was experienced in following scarce specimens among the legions of less desirable ones. About the foot of the hill was the most productive situations, but great numbers were found both on the hillside and at the top.

In a dry field of cut alfalfa some miles south of the city (elevation 4,230 feet) collecting was profitable among the stubble, although both there and in the surrounding country far fewer species were to be found than was expected and nothing of the variety found in the more barren region about Ensign Peak.

#### COLORADO.

*Grand Junction, Mesa Co.*, elevation 4,573 feet. In the dry sandy country at this locality quite good collecting was found, though recent freshets had washed over much of the ground, and the only vegetation in most places consisted of tall scraggy bushes.

*Anitlers, Garfield Co.*, elevation 5,310 feet. An area of cactus and sage at this locality proved very productive in the few minutes spent there.

*Debeque, Mesa Co.*, elevation 4,935 feet, and *Newcastle, Garfield Co.*, elevation 5,552 feet. Both localities in the rather arid cañon of the Grand River.

*Vicinity of Colorado Springs, El Paso Co.* To the east of the city in the prairie (elevation about 6,000 feet) Orthoptera were present in countless numbers. The true prairie-grass land revealed many species, while the more luxuriant grass about a small stagnant pond produced other species. This locality, while somewhat dry, was nothing like the parched sage-brush plains in which collecting was done at other places. Austin Bluffs (elevation 6,960 feet) rise abruptly from the prairie land, many dry shrubs growing upon them, plentifully interspersed with scrub pines.

*Vicinity of Manitou, El Paso Co.* The mesa (elevation 6,400 feet)

at this locality was somewhat like the prairie at Colorado Springs, but not nearly as productive. On the hillside near the Pike's Peak railroad station (elevation 6,700 feet) Orthoptera were plentiful among the high grasses and scrub oak thickets. The Garden of the Gods (elevation 6,300 feet) proved everywhere unproductive except a small field of tall grass near the Manitou street-car line. Many species were to be found here in numbers.

*Pike's Peak.* The summit of Pike's Peak (elevation 14,147 feet) is a mass of huge boulders with no apparent vegetation. The region about Windy Point (12,000–12,300 feet) is treeless and very steep. A short but sturdy grass grows everywhere that the quantity of huge jagged rocks permit, and in this grass a few species of Orthoptera such as *Gomphocerus clavatus*, *Melanoplus altitudinum*, *fasciatus* and *monticola* were quite plentiful.

Along the timber-line (11,578 feet) in the stunted vegetation Orthoptera were somewhat more varied, but not as interesting as those at Windy Point. At Middle Hudsonian (elevation 10,500 feet) and above the pump station (elevation 10,100 feet) the forest of quaking aspen was exceedingly unproductive and very few specimens were seen. In Dark Cañon (elevation 8,900–9,000 feet) in spite of an abundance of grass few Orthoptera could be found, although other forms of insect life were plentiful. On the densely wooded upper slope of Dark Cañon work was attended with less success than in the burned-over forest.

*Cripple Creek, Teller Co.*, elevation 9,591 feet. The few specimens taken at Cripple Creek were from the tailings about the mines.

*Fort Morgan, Morgan Co.*, elevation 4,338 feet. A rank growth of weeds along the railroad track at this place swarmed with Orthoptera, and in a few minutes a number of interesting forms were taken.

### MANTIDÆ.

#### LITANEUTRIA Saussure.

##### *Litaneutria minor* (Scudder).

Antlers, Colorado, Aug. 15, 1 immature ♀.

This specimen is referred to this species with some uncertainty, as it may represent *L. borealis* Bruner, which, however, is of doubtful validity.<sup>1</sup>

This individual was taken on dry soil among dense beds of cactus and sage.

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<sup>1</sup> Vide Caudell, *Proc. U. S. Nat. Mus.*, XXVIII, pp. 463, 464.

**ACRIDIDÆ.****ACRYDIINÆ.****ACRYDIUM** Geoffroy.***Acrydium granulatum*** Kirby.

Hill at head of springs, Mammoth Hot Springs, Yellowstone Park, Aug. 5, 2 immature specimens.

Careful search revealed no mature specimens.

***Acrydium crassum*** (Morse).

Manitou, Colorado, 6,324 feet, Aug. 16, 3 ♂, 8 ♀; 6,700 feet, Aug. 23, 1 ♂, 1 ♀.

This species has previously been recorded from localities in northern and north-central Colorado: Fort Collins, Laporte, Steamboat Springs, Poudre river, Platte Canyon and Denver.

This species was found among the mountain-loving plants in the immediate vicinity of scrub oak bushes. It appeared to be extremely local, for I found it in but one small area, where, however, it was common.

**ACRIDINÆ.****SYRBULA** Stål.***Syrbula admirabilis*** (Uhler).

St. Louis, Missouri, Aug. 27, 18 ♂, 12 ♀.

These specimens are inseparable from New Jersey individuals.

A common species in the tall weeds of a vacant lot in the city.

**ACROLOPHITUS** Thomas.***Acrolophitus hirtipes*** (Say).

Mammoth Hot Springs, Yellowstone Park, 6,215 and 6,500 feet, Aug. 5, 2 ♂. Colorado Springs, Colorado, Aug. 18, 4 ♂, 9 ♀. Prairie land, Colorado Springs, Aug. 18, 1 ♀. Knob Hill, Colorado Springs, Aug. 17-22, 7 ♂, 13 ♀.

This series exhibits a great range of color variation, extending from the typical blotched form to the uniform one tentatively named *uniformis* by Bruner.<sup>2</sup> The latter does not appear worthy of recognition, as the extremes and intermediates are present in both the larger series examined.

This species was quite scarce on the hillsides about the Mammoth Hot Springs, being found among sage and mountain plants. On the prairie outside of Colorado Springs the species was extremely plentiful and

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<sup>2</sup> *Biol. Cent.-Amer.*, Orth., II, p. 47.

easily captured. The insect is not swift of flight and often relies on its strongly protective coloration to escape detection.

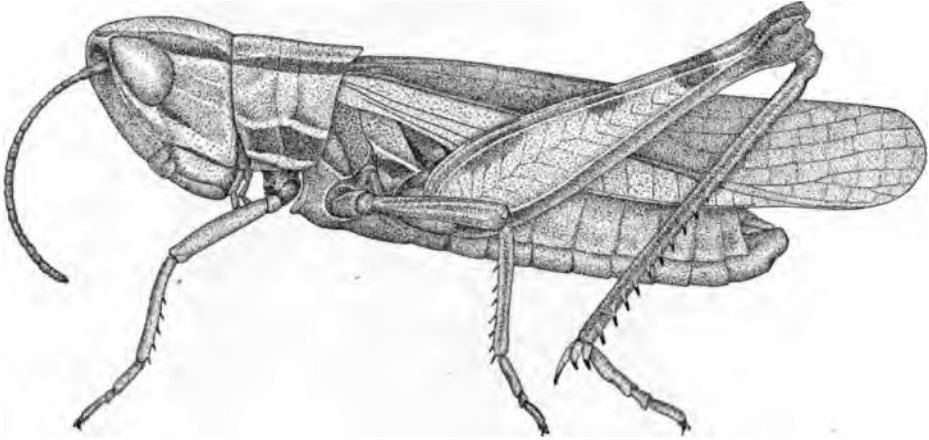


Fig. 1.—*Akentetus unicolor* McNeill. Knob Hill, Colorado Springs, Colorado. Lateral view of male. ( $\times 5$ .)

**AKENTETUS** McNeill.

***Akentetus unicolor* McNeill.**

Mammoth Hot Springs, Yellowstone Park, Aug. 5, 1 ♀. Knob Hill, Colorado Springs, Colorado, Aug. 17, 2 ♂. Akron, Washington Co., Colorado, Aug. 24, 1 ♂.

This scarce species, previously recorded only from the type locality ("Colorado") and Lakin, Kansas, is also represented in the Academy collection by a male from Nebraska and a female from Livermore, Larimer Co., Colorado, the latter taken July 23, 1899. The pattern of coloration is very similar to that of *Amphitornus*, but the longitudinal bars are narrower. In the Akron and Mammoth Hot Springs specimens the postocular regions are distinctly infusate. The bars on the caudal femora are distinct in all the specimens examined.



Fig. 2.—*Akentetus unicolor* McNeill. Knob Hill, Colorado Springs, Colorado. Dorsal view of head and pronotum of male. ( $\times 5$ .)

The four specimens of this species taken were captured in three decidedly different locations. At Mammoth Hot



Springs one was taken on the hillside among sage-brush. At Knob Hill two were captured on the prairie, while at Akron it was taken in a dry situation near the railroad.

**AMPHITORNUS** McNeill.

**Amphitornus-coloradus** (Thomas).

1872. *S[tenobothrus] bicolor* Thomas, Prelim. Rep. U. S. Geol. Sur. Montana, p. 465.<sup>3</sup>

1873. *S[tenobothrus] coloradus* Thomas, Synopsis Acrid. N. Amer., p. 82.

Mammoth Hot Springs, Yellowstone Park, Aug. 5, 4 ♀, 1 nymph. Summit of foothills near Mammoth Hot Springs, 6,500 feet, Aug. 5, 3 ♀. Hill at head of Mammoth Hot Springs, 7,000 feet, Aug. 5, 1 ♀. Salt Lake City, Utah, Aug. 13, 1 ♀. Hill near Salt Lake City, 4,700 feet, Aug. 13 and 14, 3 ♂, 2 ♀. Knob Hill, Colorado Springs, Colorado, Aug. 17-22, 4 ♂, 1 ♀. Prairie land, Colorado Springs, Aug. 18, 1 ♀.

The series examined contains both the typical form and the suffused form called "Var. *a*" by Thomas. This is apparently the first record of the species from Utah.

This species was found in Wyoming, Utah and Colorado in almost the same numbers. Each specimen seen was captured, if that was in any way possible. The insect was found among the sage on hillsides and also among the grasses of the prairie.

**OPEIA** McNeill.

**Opeia obscura** (Thomas).

Salt Lake City, Utah, Aug. 13, 1 ♀. Colorado Springs, Colorado, Aug. 18, 1 ♀. Knob Hill, Colorado Springs, Aug. 17-22, 65 ♂, 62 ♀. Prairie land, Colorado Springs, Aug. 18, 2 ♂, 2 ♀. Garden of the Gods, Colorado, Aug. 19, 1 ♂.

Specimens of this species were received from Prof. C. P. Gillette from Merino, Lamar, Snyder and Fort Collins, Colorado, labelled *Eritettix variabilis* with a query. The Salt Lake City specimen is apparently the first recorded west of the Rockies.

About Colorado Springs on the prairie this species was to be found in countless numbers. The males are very rapid in their movements, but so common were they that sometimes over a dozen would be taken with one sweep of the net.

**CORDILLACRIS** Rehn.

**Cordillacris occipitalis** (Thomas).

Colorado Springs, Colorado, Aug. 18, 1 ♀. Knob Hill, Colorado

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<sup>3</sup> Invalidated by *Stenobothrus bicolor* (Charpentier), the combination dating from Sélys-Longchamps, 1868 (*Ann. Soc. Entom. Belg.*, XI, p. 31).

Springs, Aug. 18-22, 1 ♂, 2 ♀. Austin Bluffs, Colorado Springs, Aug. 18, 8 ♂, 6 ♀. Prairie land, Colorado Springs, Aug. 18, 1 ♂.

This was an extremely scarce species on the grassy prairie, but among the low plants growing in a forest of dwarf pines on Austin Bluffs it was quite common. The insects spring about rapidly and are also able to fly well.

***Cordillaoris cinerea* (Bruner).**

Sphinx, Park Co., Montana, Aug. 4, 1 ♂. Austin Bluffs, Colorado Springs, Colorado, Aug. 18, 2 ♀.

This form appears to be hardly separable from the preceding.

The male captured was taken in the sage-brush. So rapidly did it jump about that several minutes were occupied in making the capture, as I had no net at the time.

***Cordillaoris crenulata* (Bruner).**

Antlers, Garfield Co., Colorado, Aug. 15, 2 ♀. Colorado Springs, Colorado, Aug. 18, 1 ♀. Knob Hill, Colorado Springs, Aug. 17-22, 8 ♂, 10 ♀. Austin Bluffs, Colorado Springs, Aug. 18, 1 ♀. Garden of the Gods, Aug. 17 and 19, 1 ♂, 3 ♀.

This species was quite plentiful in the grass of the prairie outside Colorado Springs. It was also taken among cactus and sage, in a damp grassy meadow and among the low scattered plants growing in a forest of dwarf pines.

***PHLIBOSTROMA* Scudder.**

***Phlibostroma quadrimaculatum* (Thomas).**

Colorado Springs, Colorado, Aug. 18, 2 ♂, 2 ♀. Knob Hill, Colorado Springs, Aug. 17-22, 56 ♂, 39 ♀. Manitou, Colorado, Aug. 23, 1 ♀. Garden of the Gods, Colorado, Aug. 17-23, 8 ♂, 5 ♀. Akron, Washington Co., Colorado, Aug. 24, 1 ♂, 1 ♀.

One of the extremely plentiful species found in the prairie. Hundreds could have been taken in a short time. Quite a diversity of coloration occurred in the specimens, for among those taken were both brown and green-marked individuals. The females were generally of the green form, while the males were more of the wholly brown type.

***ORPHULELLA* Giglio-Tos.**

***Orphulella pelidna* (Burmeister).**

Knob Hill, Colorado Springs, Aug. 17-22, 5 ♂, 5 ♀.

The separation of *O. pratorum* from this form is a task apparently hopeless. For the present at least we prefer to call these *pelidna*, as *pratorum* as understood by us, on the basis of material from the south-

eastern States and New Jersey, appears to be slenderer with longer wings. However these differential characters are only averages, numerous specimens which cannot otherwise be separated from the usual *pratorum* type being intermediate in proportions.

The species was found in short marshy grass growing about a shallow pond in the prairie. Considerable search was required to find the ten specimens captured.

***Orphulella salina* Scudder.**

Grand Junction, Colorado, Aug. 15, 1 ♂.

This species has previously been recorded from Grand Junction and Montrose, Colorado, by Caudell,<sup>4</sup> and Grand Junction and Delta by Gillette.<sup>5</sup>

This specimen was taken in short grass near the Grand river, in a locality which had been recently inundated. No other specimens of Orthoptera were seen about this location.

**DICHROMORPHA Morse.**

***Dichromorpha viridis* (Scudder).**

Table Rock, Pawnee Co., Nebraska, Aug. 25, 1 ♂, 1 ♀. St. Louis, Missouri, Aug. 27, 2 ♀.

In both localities plentiful among thick grass and weeds.

**CHLOEALTIS Harris.**

***Chloëaltis abdominalis* (Thomas).**

Summit of foothill of Gallatin Range, Mammoth Hot Springs, Yellowstone Park, 7,000 feet, Aug. 5, 4 ♂, 7 ♀. Manitou, Colorado, 6,300-6,900 feet, Aug. 23, 7 ♂, 4 ♀.

The male individuals are inseparable from a specimen of the same sex from Pequaming, Michigan, while the females are similar to individuals of that sex from Manitoba and Truchas Peak, New Mexico. The Truchas Peak specimen is slightly smaller with rather slenderer caudal limbs.

This species was doubtfully recorded from Colorado by Cockerell<sup>6</sup> as taken at Willow Creek, Cusack Ranch, Custer County, in September.

At Mammoth Hot Springs I found this species in a small glade at the top of the foothills. Here in the thick grass growing about a clump of aspen the series listed above was taken with little difficulty. The males of this species are very quick and wary, but the females are

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<sup>4</sup> *Proc. U. S. Nat. Mus.*, XXVI, p. 782.

<sup>5</sup> *Bull. 94, Colo. Agr. Exp. Sta.*, p. 26.

<sup>6</sup> *Trans. Amer. Ent. Soc.*, XX, p. 337.

extremely heavy and slow, and appear to rely a great deal on their protective resemblance to a bit of twig. The stridulation of the

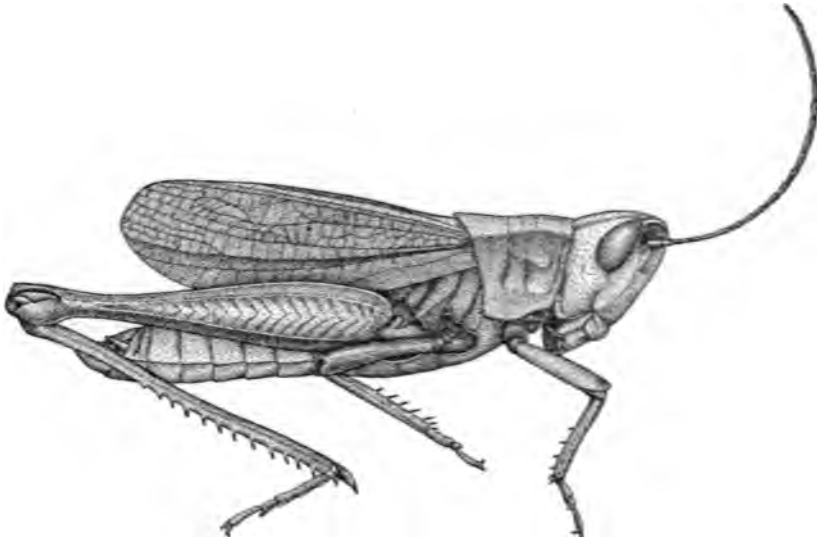


Fig. 3.—*Chloëaltis abdominalis* (Thomas). Manitou, Colorado. Lateral view of male. ( $\times 4$ .)



Fig. 4.—*Chloëaltis abdominalis* (Thomas). Mammoth Hot Springs, Yellowstone Park. Lateral view of female. ( $\times 3$ .)

males much resembles that of *C. conspersa*, but is not nearly so loud.

At Manitou, I found this species in about the same numbers among the scrub oaks and mountain-loving plants of a steep hillside. The

species appeared to be very local in habitat and, if a colony of the insect is not found, long search for the species would very probably be useless.

**STAURODERUS** Bolivar.<sup>7</sup>

***Stauroderus curtispennis*** (Harris).

Muir, Bozeman Tunnel, Park-Gallatin Co., Montana, Aug. 12, 1 ♀. Sappington, Gallatin Co., Montana, Aug. 12, 1 ♂. Hill at head of Mammoth Hot Springs, Yellowstone Park, Aug. 5, 2 ♂, 1 ♀. Fountain, Lower Geyser Basin, Yellowstone Park, Aug. 6, 1 ♂. Near Grand Cañon, Yellowstone Park, 8,000 feet, Aug. 10, 2 ♂, 2 ♀. Yellowstone Lake, Aug. 8, 5 ♂, 4 ♀. Emerald Springs, Yellowstone Park, Aug. 7, 2 ♂, 2 ♀. Knob Hill, Colorado Springs, Aug. 17, 1 ♀. Manitou, Colorado, Aug. 16 and 23, 5 ♂, 5 ♀.

These specimens vary considerably in size and somewhat in structure, but such variation is paralleled in Eastern specimens, from which they cannot be separated.

This species was rather boreal in distribution and was found in numbers in tall marshy grass in a large open pasture on the shore of Yellowstone Lake. It was also found plentiful at Manitou, Colorado, in the same locality as *Chloëaltis abdominalis*. At Muir, Mammoth Hot Springs and Manitou the species was found in dry locations, all the other localities in which it was found being more or less damp. The stridulations of the males resemble sik-sik-sik-sik swiftly repeated, the sound being neither loud nor sharp.

**PLATYBOTHRUS** Scudder.

***Platybothrus brunneus*** (Thomas).

Mammoth Hot Springs, Yellowstone Park, Aug. 5, 2 ♂. Summit of foothills near Mammoth Hot Springs, Aug. 5, 4 ♂, 4 ♀. Summit of foothill of Gallatin Range, Mammoth Hot Springs, Aug. 5, 1 ♂, 5 ♀.

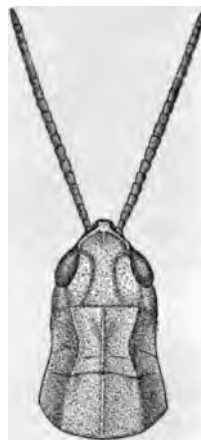


Fig. 5.—*Chloëaltis abdominalis* (Thomas). Mammoth Hot Springs, Yellowstone Park. Dorsal view of head and pronotum of female. (×3.)

<sup>7</sup> This generic name (*Catal. Sinopt. Ortópt. Fauna Ibérica*, pp. 46, 57, 1898) should be used in this connection in place of *Stenobothrus* if we recognize Bolivar's divisions as genera, as has been done by Burr (*Entom. Record and Journ. Variat.*, XVI, p. 320). If these groups are recognized as of only subgeneric rank, Fieber's *Chorthippus* must be used as the generic term in place of *Stenobothrus*, as has already been done in several previous papers by the senior author.

On geyser formation, Mammoth Hot Springs, Aug. 5, 1 ♀. Top of bare hill opposite Devil's Kitchen, Mammoth Hot Springs, Aug. 5, 1 ♀. Meadows near Norris Pass, Continental Divide, Yellowstone Park, Aug. 5, 1 ♀. Near Grand Cañon, Yellowstone Park, Aug. 10, 2 ♂.

These specimens have the caudal tibiae with pale proximal annuli followed by dull glaucous and with the distal third reddish.

This species is distinctly boreal and apparently uncommon in collections, the only definite records being from Fort McLeod, southern Alberta, several localities in Idaho, Fort McKinney, Wyoming, and Estes Park, Colorado. Individuals from all except the Idaho localities have been examined.

The specimens taken were all found among the more boreal forms of vegetation in the Park. Nowhere was it possible to take a large series of specimens, in spite of the fact that when found individuals were easily captured. The insects move about quite hurriedly on the ground, and when disturbed can also use their wings advantageously.

#### GOMPHOCERUS Thunberg.

##### *Gomphocerus clavatus* Thomas.

Mammoth Hot Springs, Yellowstone Park, Aug. 5, 6 ♀. Summit of foothill of Gallatin Range, Mammoth Hot Springs, Aug. 5, 1 ♀. Manitou, Colorado, 6,800-7,000 feet, Aug. 23, 2 ♂, 5 ♀. Pike's Peak, 10,200 feet, Aug. 20, 1 ♀; Dark Cañon, 8,920-9,000 feet, Aug. 16, 8 ♂, 4 ♀; above Windy Point, 12,300 feet, Aug. 20, 16 ♂, 8 ♀, 6 nymphs; below Windy Point, 12,000 feet, Aug. 20, 6 ♂; along timber line, 11,578 feet, Aug. 20, 1 ♂; Mountain View, 9,700 feet, Aug. 20, 2 ♂, 5 ♀.

With this series of nearly seventy specimens, and twenty others in the collection of the Academy, we are unable to find any constant character or characters to separate the three so-called American species of this genus. We have attempted to apply the characters given by Bruner<sup>8</sup> to distinguish them, but the Windy Point series exhibits enough variation to prove the futility of attempting to recognize several species. The length of the antennae and the angulation of the fastigium vary to a great extent, and the inflation of the cephalic tibiae of the males apparently is as variable as in the European species of the genus.

I found this species by no means abundant about the Mammoth Hot Springs, but took it in both the highest and lowest locations. On

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<sup>8</sup> *Biol. Cent.-Amer.*, Orth., II, pp. 92, 93.

the hillside above Manitou, Colorado, I found the species in about the same numbers as at the Hot Springs. From Dark Cañon to the highest grassy locations on Pike's Peak, however, the species was common in all favorable locations. The insects were found most common in all open grassy spots, especially above the timber-line where short grasses grow everywhere between the scattered boulders. The males are very active and are constantly stridulating—sik-sik-sik-sik—a sound louder but similar to that produced by *Stauroderus curtispennis*. The females are slow and clumsy in their movements, appearing quite different from the males.

**PSOLOESSA** Scudder.

***Psoloessa maculipennis*** Scudder.

Knob Hill, Colorado Springs, Colorado, Aug. 17, 1 ♀.

This specimen is somewhat smaller than Kansas and New Mexican individuals of the species. The previous Colorado record of this species was simply "Southern Colorado."

While sweeping the prairie grass, a single specimen of this species was taken from among the hundreds of more common species. So great was the number of common Orthoptera in this locality that it was impossible to search for the scarcer individuals, but this species was not met with again even though much sweeping was done in the same vicinity.

**AGENEOTETTIX** McNeill.

***Ageneotettix deorum*** (Scudder).

Livingston, Park Co., Montana, Aug. 4, 1 ♂. Salt Lake City, Utah, Aug. 13-14, 9 ♂, 6 ♀. Grand Junction, Colorado, Aug. 15, 1 ♂. Antlers, Colorado, Aug. 15, 3 ♂, 1 ♀. Knob Hill, Colorado Springs, Colorado, Aug. 17-22, 73 ♂, 87 ♀. Austin Bluffs, Colorado Springs, Aug. 18, 2 ♀. Manitou, Colorado, Aug. 16, 3 ♂, 2 ♀. Garden of the Gods, Colorado, Aug. 17 and 19, 3 ♂, 3 ♀. Roggen, Weld Co., Colorado, Aug. 24, 1 ♀. Akron, Washington Co., Colorado, Aug. 24, 2 ♂.

With this extensive series before me, I am unable to separate Bruner's *scudderi* and *occidentalis*. The characters given by him in his key of the species of this genus<sup>9</sup> do not appear to be constant, as specimens from the type locality (Garden of the Gods) cannot be separated from others from the supposed range of *occidentalis* (Salt Lake City, Grand Junction and Antlers), while a sufficient series from any one locality

<sup>9</sup> *Bull. 94, Colo. Agr. Exp. Sta.*, p. 58, 1904.

contains individuals with the characters supposed to be diagnostic of any of the three forms and numerous others which cannot be placed in one or the other of the three "species."

This was one of the most plentiful species encountered. It was found in many of the arid localities, but on the prairie it truly swarmed. Each sweep of the net would take a dozen or more specimens in this location, and so great were its numbers that other scarcer specimens, even when seen, would often easily escape in the myriads of this species.

**AULOCARA** Scudder.

***Aulocara elliotti*** (Thomas).

Gray Cliff, Sweet Grass Co., Montana, Aug. 4, 2 ♂, 4 ♀. Livingston, Park Co., Montana, Aug. 4, 1 ♀. Electric, Park Co., Montana, Aug. 4, 1 ♀. Summit of foothills near Mammoth Hot Springs, Yellowstone Park, Aug. 5, 5 ♂, 6 ♀. Top of Ensign Peak, Salt Lake City, Utah, Aug. 13, 1 ♀. Knob Hill, Colorado Springs, Colorado, Aug. 17 and 22, 3 ♂. Prairie land, Colorado Springs, Aug. 18, 3 ♀. Garden of the Gods, Aug. 17, 19 and 23, 11 ♂, 4 ♀.

The largest series of this species was taken in a meadow of tall grasses and weeds at the western entrance of the Garden of the Gods. It was also taken on the prairie at Colorado Springs, in dry grass and sage at Gray Cliff and in the other localities in hilly sage-brush locations.

***Aulocara femoratum*** Scudder.

Gray Cliff, Sweet Grass Co., Montana, Aug. 4, 1 ♂. Garden of the Gods, Colorado, Aug. 17, 19 and 23, 3 ♀.

As stated by Gillette<sup>10</sup> the females of this species are very similar to the same sex of *elliotti*, and rather difficult to distinguish. The slenderer caudal femora of *femoratum* are probably one of the best differential characters. The Montana record is the most northerly for the species.

The specimen taken in Montana was captured among the dried grasses in prairie land. Had I had more time in this locality I think more specimens could possibly have been taken. In the Garden of the Gods the species was scarce, the only individuals taken being captured in the grass near the western entrance.

***Aulocara parallelum*** Scudder.

Hillside at Salt Lake City, Utah, Aug. 13, 2 ♂, 2 ♀. Top of Ensign Peak, Salt Lake City, Aug. 13, 1 ♂, 1 ♀. Antlers, Colorado, Aug. 15, 2 ♂.

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<sup>10</sup> Bull. 94, Colo. Agr. Exp. Sta., p. 30, 1904.



The color of the caudal tibiae, which were missing in the types, is similar to that of *A. elliotti*, with the pale proximal annuli more dis-

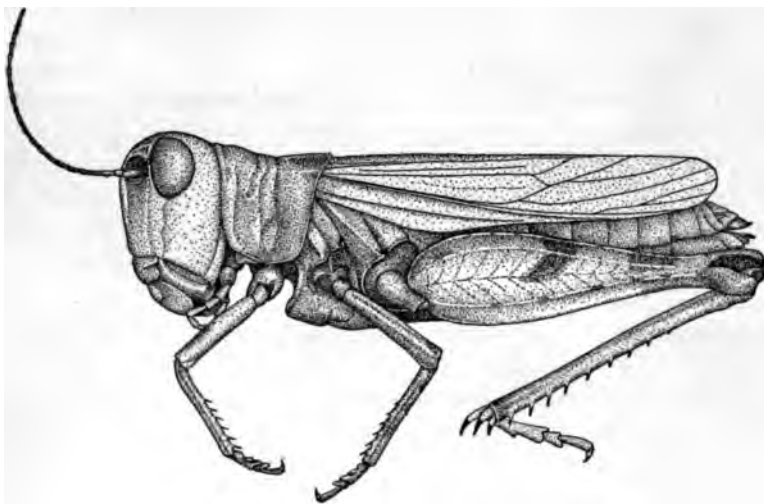


Fig. 6.—*Aulocara parallelum* Scudder. Salt Lake City, Utah. Lateral view of female. ( $\times 3$ .)

tinct in the females than in the males. The blackish postocular stripe mentioned by Scudder appears to be a variable character and is absent in some specimens and distinct in others.

The Antlers specimens are the first recorded outside of Salt Lake Valley.

This species was scarce in both localities in which it was taken. I found it on dry soil overgrown with sage, and owing to the activity of the individuals not many of even the few seen were taken. The caudal limbs of this species are so loosely attached that they snap off at the least strain and perfect specimens were consequently difficult to secure.

#### CEDIPODINÆ.

##### ARPHIA Stål.

##### *Arphia pseudonietana* (Thomas).

Upper Geyser Basin, Yellowstone Park, Aug. 7, 3 ♂, 1 ♀. Salt Lake City, Utah, Aug. 13, 1 ♂. Hill-side at Salt Lake City, Aug. 14, 1 ♂, 1 ♀. Prairie



Fig. 7.—*Aulocara parallelum* Scudder. Salt Lake City, Utah. Dorsal view of head and pronotum of female. ( $\times 3$ .)

land, Colorado Springs, Colorado, Aug. 18, 1 ♂, 1 ♀. Akron, Colorado, Aug. 24, 1 ♂.

This series presents the variation in the intensity of the overlying blotches of dark brown usual in the species, and which in specimens of a light base color produces a strongly maculate type. The specimens from Upper Geyser Basin all have the sutural margin of the tegmina distinctly and broadly marked with pinkish ochraceous.

In the Upper Geyser Basin this species was to be found in small numbers in the small grassy spots between the geyser formations and the Firehole river. In the other localities the species was scarce. Its flight is very vigorous and accompanied by a loud clattering.

***Arphia areta* Scudder.**

Hill at head of Mammoth Hot Springs, Yellowstone Park, Aug. 5, 1 ♂.

This specimen has the wings orange red.

The individual collected was the only representative of the species seen.

**CHORTOPHAGA Saussure.**

***Chortophaga viridifasciata* (De Geer).**

St. Louis, Missouri, Aug. 27, 1 ♀.

**ENCOPTOLOPHUS Scudder.**

***Encoptolophus coloradensis* Bruner.**

Knob Hill, Colorado Springs, Colorado, Aug. 17, 1 ♂.

The recognition of this distinct species was quite a surprise. Its closest ally is *E. sordidus*, from which it is separated by numerous

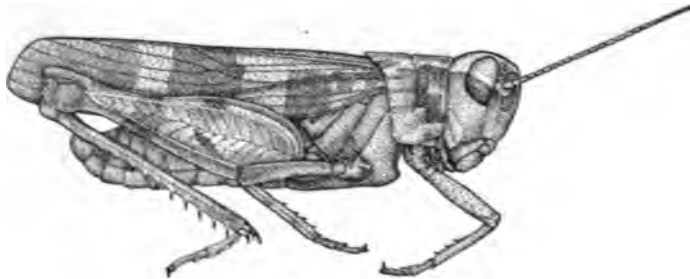


Fig. 8.—*Encoptolophus coloradensis* Bruner. Knob Hill, Colorado Springs, Colorado. Lateral view of male. ( $\times 3$ .)

characters. The only published record is the original description, the type being from Fort Collins, Colorado.

This specimen was beaten from the rank growth of weeds about a small water-filled depression in the prairie. Owing to the immense number of common species in this place no other specimens of this species was noticed, and much beating in the same locality failed to secure additional specimens.

#### CAMNULA Stål.

##### *Camnula pellucida* (Scudder).

Waco, Montana, Aug. 4, 3 ♂, 2 ♀. Emigrant, Montana, Aug. 4, 1 ♀. Daileys, Montana, Aug. 4, 1 ♀. Sphinx, Montana, Aug. 4, 1 ♀. Electric, Montana, Aug. 4, 1 ♀. Muir, Bozeman Tunnel, Montana, Aug. 12, 1 ♂, 2 ♀. Sappington, Montana, Aug. 12, 1 ♂. Spire Rock, Montana, Aug. 12, 1 ♂. Mammoth Hot Springs, Yellowstone Park: hill at head of springs, Aug. 5, 1 ♀; on geyser formation at the upper end of springs, Aug. 5, 1 ♂. Fountain, Lower Geyser Basin, Yellowstone Park, Aug. 6, 1 ♂. Upper Geyser Basin, Yellowstone Park, Aug. 7, 1 ♂. The Thumb, Yellowstone Park, Aug. 7, 1 ♀. Near Grand Cañon, Yellowstone Park, Aug. 10, 1 ♀. Yellowstone Lake, Aug. 7, 1 ♀. Upper slope of Dark Cañon, Pike's Peak, Colorado, Aug. 16, 4 ♂, 1 ♀, 1 nymph.

The specimens from Waco are very interesting as they are exceedingly pale in color, some appearing rather uniform dull straw color with the maculations much reduced and quite feeble; others have the maculations distinct but the lighter shades all the same color as in the other pale individuals. The specimen from geyser formation at Mammoth Hot Springs is coated with the mineral deposit.

This species was one of the most plentiful of those found in Montana. At Waco the insects fairly swarmed in the dry prairie grass and sage. In this locality the specimens were extremely pale in coloration; exactly the color of the plants on which they were found. I have never seen greater swarms of insects than those of *C. pellucida* in the sage at the foot of the hills at Mammoth Hot Springs. The species was everywhere in Montana far more plentiful in the low dry locations, but in Colorado I found it only at a considerable elevation in Dark Cañon, Pike's Peak. One specimen was found in the Mammoth Hot Springs completely coated by the white formation. In another spring quite a few specimens of this and other species were found dead, killed probably by the fumes.



Fig. 9.—*Encyrtolophus coloradensis* Bruner. Knob Hill, Colorado Springs, Colorado. Dorsal view of head and pronotum of male. (×3.)

**HIPPISCUS** Saussure.**Hippiscus rugosus** (Scudder).

St. Louis, Missouri, Aug. 27, 1 ♀.

A single specimen of this species was seen and taken in a vacant city lot overgrown with weeds.

**Hippiscus conspicuus** Scudder.

Colorado Springs, Aug. 17, 1 ♀.

But one specimen of this species was seen.

**Hippiscus maculatus** Scudder.

Mammoth Hot Springs, Yellowstone Park: summit of neighboring foothills, Aug. 5, 1 ♀; summit of foothills of Gallatin Range, Aug. 5, 1 ♀.

A little doubt is attached to the identification of these specimens.

This species was scarce, but other specimens could have been taken had not the country been so hilly. Specimens would rise from the sage-brush hillside and fly some distance much more swiftly than one could follow.

**Hippiscus altivolus** Scudder.

Near Mountain View, Pike's Peak, Colorado, 10,100 feet, Aug. 20, 1 ♂.

This is apparently the first additional record of the species since the

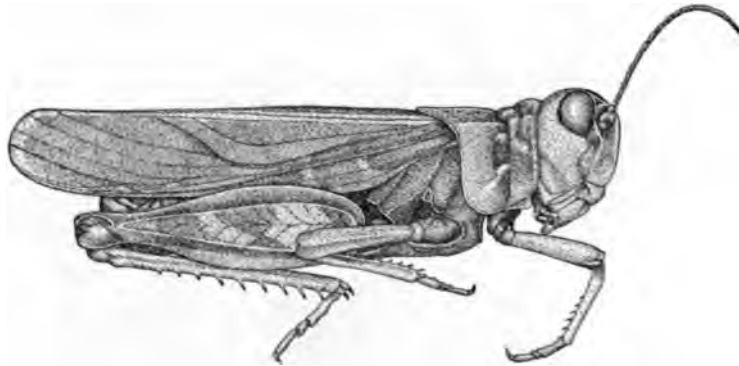


Fig. 10.—*Hippiscus altivolus* Scudder. Pike's Peak, Colorado. Lateral view of male. (× 3.)

original description (Mt. Lincoln, Colorado, above timber, 11,000–13,000 feet above sea-level; Como, Colorado, 9,500 feet).

This specimen was found on the cog-wheel railroad track, in a spot where on each side almost the only vegetation was a dense thicket of aspen. The insect's flight was erratic and exceedingly swift.

**Hippisus neglectus** (Thomas).

Mammoth Hot Springs, Yellowstone Park, Aug. 5, 3 ♀; summit of neighboring foothills, Aug. 5, 2 ♂, 4 ♀; summit of foothills of Gallatin Range, Aug. 5, 3 ♀; hill at head of springs, Aug. 5, 1 ♂; top of bare hill opposite Devil's Kitchen, Aug. 5, 1 ♂, 3 ♀. Upper Geyser Basin, Yellowstone Park, Aug. 7, 1 ♀. The Thumb, Yellowstone Park, Aug. 7, 1 ♂. Knob Hill, Colorado Springs, 7,000 feet, Aug. 17, 1 ♀.

This species varies considerably in size and greatly in the intensity of the color pattern and the sutural stripe. Individuals from Camas Prairie, Idaho, have been used for comparison.

About the Mammoth Hot Springs this species was the most plentiful of the larger Orthoptera. It preferred the hillsides to other locations, and, owing to its somewhat lighter form than other species of the genus found in that locality, it proved swift of flight and not always easy to capture. The single specimen taken at The Thumb was found in a small grassy space in the woods. Only one specimen was seen on the grassy prairie at Knob Hill, Colorado Springs.

**LEPRUS** Saussure.**Leprus interior** Bruner.

Salt Lake City, Utah, Aug. 13, 1 ♀. Hillside at Salt Lake City, Aug. 13 and 14, 4 ♂, 7 ♀.

These individuals agree well with a pair received from Prof. Bruner labelled Salt Lake City, and as a series are smaller and more conspicuously colored than a pair of *L. cyaneus* from Nephista, Colorado. The latter have the dark bars on the tegmina subobsolete, the light sutural stripes and a transverse median light bar being the only distinct markings. In the Salt Lake specimens the bars are distinct and rather regular, comparatively little variation being exhibited. Several of the latter specimens have the blue of the caudal tibiæ weaker than in the other individuals.

This series was only taken after long and careful search. There was but one place on the steepest portion of Ensign Peak where the insect could be found, and although the females were easily captured when found, the males flew vigorously. So steep was the hillside that it was bare of everything but scattered grasses and an occasional sage-bush. When at rest the insects were wonderfully protected by their coloration.

**DISSOSTEIRA** Scudder.**Dissosteira carolina** (Linnaeus).

Billings, Yellowstone Co., Montana, Aug. 4, 1 ♂, 1 ♀. Salt Lake

City, Utah, Aug. 13 and 14, 2 ♀. Grand Junction, Colorado, Aug. 15, 1 ♂, 1 ♀. Colorado Springs, Colorado, Aug. 17, 3 ♂, 2 ♀. Knob Hill, Colorado Springs, Aug. 17-22, 6 ♂, 1 ♀. Fort Morgan, Morgan Co., Colorado, Aug. 24, 1 ♀.

Everywhere common in dusty locations.

***Dissosteira longipennis* (Thomas).**

Colorado Springs, Colorado, Aug. 17 and 18, 2 ♂, 1 ♀. Knob Hill, Colorado Springs, Aug. 17 and 18, 4 ♂, 1 ♀.

Specimens have also been examined from Denver, Pueblo, Fort Morgan and La Junta, Colorado, and Sidney, Nebraska.

A somewhat scarce species and one of the wariest insects collected. I found the specimens on the prairie, and would sometimes be obliged to follow one several hundred yards before an opportunity was offered to capture it. The flight of this insect is swift and high and often of considerable length.

***Dissosteira spureata* Saussure.**

Salt Lake City, Utah, Aug. 13 and 14, 13 ♂, 5 ♀.

This series exhibits a great amount of variation in the intensity of the color pattern, some individuals being very dull, almost uniform, while others have a strikingly contrasted pattern. As previously remarked by Saussure, this species bears a considerable superficial resemblance to *Spharagemon venustum*.

These specimens were all taken in a field of alfalfa stubble. Although in this locality the species was abundant, specimens were not taken with ease owing to their extreme wariness and their sudden zigzag flight. Their coloration was of great protective value, as when at rest it was almost impossible to distinguish them from the dried alfalfa.

**SPHARAGEMON Scudder.**

***Spharagemon aequale* (Say).**

Colorado Springs, Colorado, Aug. 17 and 18, 3 ♂, 3 ♀. Knob Hill, Colorado Springs, Aug. 18, 1 ♂, 1 ♀. Prairie land, Colorado Springs, Aug. 18, 1 ♂, 4 ♀. Salt Lake City, Utah, Aug. 13, 2 ♂, 3 ♀. Hill-side at Salt Lake City, Aug. 14, 1 ♀.

One specimen only is collared, a female from the prairie at Colorado Springs.

This species was moderately abundant on the grassy plain near Colorado Springs and was easily captured, as it was by no means as active as other species of the genus.

**Spharagemon belli** Scudder.

Knob Hill, Colorado Springs, Colorado, 7,000 feet, Aug. 17, 2 ♂. Manitou, Colorado, 6,900-7,000 feet, Aug. 23, 5 ♂, 3 ♀.

These specimens are not separable from New Jersey specimens of the species.

Very few specimens of this species were found on the prairie, but it was quite common on a path leading through pine woods on the hills above Manitou.

**Spharagemon collare** (Scudder).

Billings, Yellowstone Co., Montana, Aug. 4, 1 ♂. Colorado Springs, Colorado, Aug. 17 and 18, 2 ♂, 4 ♀. Knob Hill, Colorado Springs, Aug. 17-22, 14 ♂, 37 ♀. Roggen, Weld Co., Colorado, Aug. 24, 1 ♂.

The specimen from Billings is assigned here with some doubt. One of the most plentiful of the large species found on the prairie.

**Spharagemon collare angustipenne** Morse.

Salt Lake City, Utah, Aug. 13, 2 ♀.

The two individuals recorded here were taken in the stubble field in which *Dissosteira spurcata* was abundant. This form appeared to be quite scarce.

**DEROTMEMA** Scudder.**Derotmema cupidineum** Scudder.

Whitehall, Jefferson Co., Montana, Aug. 12, 1 ♂. Grand Junction, Mesa Co., Colorado, Aug. 15, 4 ♂, 3 ♀. Antlers, Garfield Co., Colorado, Aug. 15, 9 ♂, 3 ♀.

These specimens are slightly larger than the original measurements given by Scudder, but otherwise fit the description quite well. The species appears to be readily separable from *D. haydeni* by the slightly longer and distinctly slenderer caudal femora. The pectinate character of the metazonal rugosities is not characteristic of *haydeni*, as each of the above series contains specimens in that respect not differing from *haydeni*, but the femora show them to be *cupidineum*. The Grand Junction specimens as a series are more suffused than the Antlers individuals.

The previous Colorado records of this species are from White river, near the Utah boundary, Montrose, Grand Junction and Palisades.

The specimens taken at Grand Junction were captured on the recently inundated silt along the bank of the Grand river where numerous specimens were seen. Those from Antlers were captured on the dry cactus and sage plain.

***Derotmema haydenii* (Thomas).**

Colorado Springs, Colorado, Aug. 17, 8 ♂, 7 ♀. Prairie land, Colorado Springs, Aug. 18, 3 ♂, 4 ♀, 1 immature individual. Knob Hill, Colorado Springs, Aug. 17-22, 8 ♂, 8 ♀. Garden of the Gods, Colorado, Aug. 17 and 23, 4 ♂, 3 ♀. Fort Morgan, Morgan Co., Colorado, Aug. 24, 1 ♂, 1 ♀.

Both red and yellow winged forms are represented in this series.

One of the common prairie species, which I often found in large numbers about damp depressions in the prairie and on the sandy borders of several shallow ponds.

**MESTOBREGMA Scudder.<sup>11</sup>*****Mestobregma plattei* (Thomas).**

Austin Bluffs, Colorado Springs, Colorado, Aug. 18, 2 ♀. Garden of the Gods, Colorado, Aug. 23, 1 ♀.

But three specimens of this species were seen, although much time was spent searching for additional specimens. The insects were found around stunted pines and bushes growing on cliff-like outcroppings in both localities. One specimen had just emerged. The flight of this species is low but swift.

***Mestobregma kiowa* (Thomas).**

Mammoth Hot Springs, Yellowstone Park, top of bare hill opposite Devil's Kitchen, Aug. 5, 1 ♀. Prairie land, Colorado Springs, Colorado, Aug. 18, 2 ♂, 3 ♀. Austin Bluffs, Colorado Springs, Aug. 18, 1 ♀. Knob Hill, Colorado Springs, Aug. 17-22, 41 ♂, 40 ♀. Manitou, Colorado, Aug. 16 and 23, 3 ♂. Garden of the Gods, Colorado, Aug. 17, 15 ♂, 11 ♀. Roggen, Weld Co., Colorado, Aug. 24, 1 ♀.

This large series exhibits the usual amount of variation in maculations seen in this species, chiefly in the intensity of those on the head and pronotum and in the line between the discoidal and anal areas of the tegmina. One female from Knob Hill has the anal area of the tegmina sub-roseate.

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<sup>11</sup> The authors cannot agree with Prof. Bruner's suppression of the genus *Mestobregma* (*Ent. News*, XVI, pp. 259-260) on the grounds that the insect on which it was erected was not *Cedipoda plattei* Thomas, as stated by Scudder, but one later described by Saussure as *Psinidia* (*Trachyrhachis*) *pardalina*. Granting this to be so, the action of the author, and not his intention, should alone be considered, and as *Mestobregma* was based on *Cedipoda plattei* Thomas, regardless of material in hand, it should rest on that specific name. The question of the application of the bird genus *Ixoreus* Bonaparte is a parallel case, for discussion of which see Sclater, *Ibis*, 1903, p. 142, the final ruling on which case by the American Ornithologists' Union Committee on Nomenclature (*vide Auk*, XXI, p. 424) being similar to the opinion expressed above.



An extremely abundant species wherever found, but swarming in certain grassland locations.

***Metobregma thomasi* Caudell.**

St. Louis, Missouri, Aug. 27, 3 ♂, 1 ♀.

These specimens are not separable from male individuals from Indiana received from Prof. Blatchley.

Found in a field overgrown with tall weeds in the city.

**METATOR McNeill.**

***Metator pardalinus* (Saussure).**

Waco, Montana, Aug. 4, 1 ♂, 3 ♀. Knob Hill, Colorado Springs, Colorado, Aug. 17 and 22, 1 ♂, 2 ♀. Prairie land, Colorado Springs, Aug. 18, 6 ♂, 2 ♀.

Of the series here mentioned nine possess red or reddish wings, five yellow wings and one (Colorado Springs, prairie, Aug. 18, ♀) has the wings orange. The evidence of this material would thus support the view held by Caudell,<sup>12</sup> who regards *Psinidia maculosa* Saussure as merely the yellow winged form of *pardalinus*, an opinion entertained as possible by Saussure in the original description, his words being, 'Annæ præcedentis varietas?'

The Waco record is the most northern for true *pardalinus*, but if *maculosa* is identical the range is extended as far north as Fort McLeod, Alberta.

The specimens taken at Waco were captured among the sage-brush where the species appeared extremely plentiful. I also found this species plentiful at Colorado Springs, in the prairie wherever there was a damp depression. The insect is not swift of flight and may be easily taken with a net.

**CONOZOA Saussure.**

***Conozoa sulcifrons* (Scudder).**

Grand Junction, Mesa Co., Colorado, Aug. 15, 11 ♂, 12 ♀.

Several specimens of this species were submitted to Mr. A. N. Caudell for comparison with material in the U. S. National Museum, and his remarks are quite interesting and worthy of record. In part he writes: "They are not *Conozoa wallula*; they are either *C. sulcifrons* or *behrensi* . . . I can scarcely tell these species apart. *Behrensi* is supposed to have shorter wings and elytra, have the median carina of the prozona more deeply cut and have the wing-bands wider. I have

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<sup>12</sup> *Proc. U. S. Nat. Mus.*, XXVI, p. 790.

typical specimens of it from California . . . these are quite distinct, but a good series before me grades into the *sulcifrons* form." Specimens of *behrensi* from San Diego and Claremont, California, appear readily separable from the Grand Junction individuals, but these are probably typical specimens.

This species has a rather wide distribution, having been recorded from Nogales and the Huachuca mountains, southern Arizona, in addition to the type locality and Grand Junction, Colorado. It would thus appear to be an Upper and Lower Sonoran species.

I took this species on the bare silt along the banks of the Grand river. In this locality it was plentiful and many specimens could easily have been taken as their flight is short and not vigorous. The coloration of the insects is undoubtedly of great protective value.

**TRIMEROTROPIS Stal.**

***Trimerotropis bilobata* n. sp.**

Types: ♂ and ♀; Antlers, Mesa Co., Colorado, Aug. 15, 1904. Collected by Morgan Hebard. [Hebard Collection.]

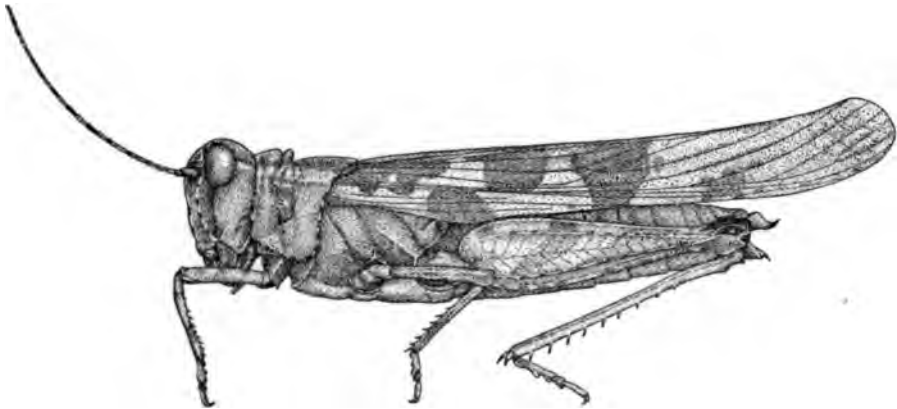


Fig. 11.—*Trimerotropis bilobata* n. sp. Antlers, Colorado. Lateral view of type. (× 3.)

This species is one of a number which might with almost equal propriety be placed in either *Conozoa* or *Trimerotropis*, but which we have placed here chiefly because McNeill has considered its allied species as a member of *Trimerotropis* rather than *Conozoa*.

The new form is apparently closely allied to *T. rebellis* (Saussure) and differs in the absence of a distinct projecting process on the ventro-caudal angle of the pronotum, in the apparently less distinct lateral

angles of the pronotum, the more distinct *Conozoa*-like tegminal bars and the color of the caudal femora.

The great elevation of the prozonal section of the median carina of the pronotum immediately separates it from most of the species. No close relationship exists to *Conozoa wallula* or any of the recently described species of that genus, the whole build being different from that seen in most of the forms of that genus, although *C. acuminata* approaches it very closely in this respect.

Size small; form compressed, slender and elongate; surface finely punctate. Head with the occiput considerably elevated, domed; vertex but slightly lower than the summit of the eyes; fastigium strongly declivent, rather broad in both sexes, greatest width very slightly more than the length, lateral margins distinct and very distinctly converging cephalad, passing into the carinae of the frontal costa without interruption, median carina of the fastigium precurrent, less distinct than the lateral margins of the same; frontal costa rather regularly but not strongly expanding ventrad, the margins subparallel for a short distance around the median ocellus, median sections distinct sulcate, less so dorsad, the marginal carinae reaching the clypeal margin; antennae slightly less than twice the length of the head and pronotum, slightly depressed; eye subovoid, moderately prominent particularly in the male, slightly greater than (male) or equal to (female) the length of the infra-ocular sulcus. Pronotum rather narrow; cephalic margin of the dorsum very obtuse-angulate, caudal

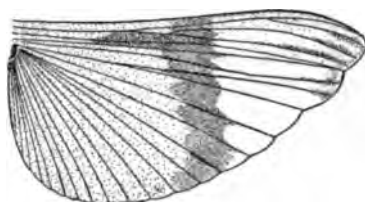


Fig. 12.—*Trimerotropis bilobata* n. sp.  
Wing. (× 2.)

margin very slightly obtuse-angulate; median carinae cristate on the prozona and strongly divided into two lobes by the first sulcus, the incision being V-shaped and quite broad in the male and very narrow in the female, the cephalic lobe is subtrigonal in the male and lower and more longitudinally rounded in the female, second lobe equal to the first lobe in height and rounded dorsad in both sexes; carina of the metazona subcristate in both sexes; prozona about two-thirds the length of the metazona; lateral angles of the disk very distinct, and slightly carinate on the cephalic section of the metazona; lateral lobes slightly deeper than long, the ventro-caudal angle rounded with a very slight indication of a ventral blunt protuberance.

Tegmina elongate, narrow, subequal in width, the costal dilation

slight and rounded; apex slightly recurved dorsad, rounded obliquely truncate; intercalary vein distinct, about intermediate in position except dorsad where it regularly approaches and joins the median vein. Wings long and narrow, the width being contained twice in the length; costal margin evenly and very gently arcuate in the distal half; apex very narrowly rounded; axillary field arcuate apically. Caudal femora quite slender, gently tapering, the width contained about three and a half times in the length, pregenicular constriction not great, pagina rather flat, the sculpturing regular and quite distinct; caudal tibiae with nine spines on the external margins.

General colors ecru drab overlaid with bistre in the male, the lighter color on the head and pronotum hoary white. Head with the facial and costal carinae maculate with blackish brown, a large maculation beneath the base of each antenna and the ventral section of the eye marked with the same color in the male, the ventro-caudal section of the genae being washed with the same tint and a postocular stripe indicated, while the fastigium is marked with pale cinnamon-rufous and a pair of arcuate diverging bars of the same color are present on occiput as well as a blackish interocular bar on the vertex; antennae rather broadly annulate with the two general colors. Female with the head finely sprinkled with blackish spots with a trace of a light postocular bar. Pronotum of the male with a median bistre area which narrows caudad and the lateral lobes of prozona are strongly washed with bistre, forming a contrast with the hoary metazona. Pronotum of the female marked much as in the male, but the whole darker and without light colors, while the lateral angles of the disk and a distinct oblique bar on the lateral lobes of the prozona are darker than any of the other pronotal markings. Tegmina with two complete transverse bars, one median, one at the proximal fourth and an incomplete bar just distad of the median transverse one, which is broader mesad than at the costal and sutural margins, the bar at the basal fourth toward the sutural margin approaching the median bar and also extending proximad in the intercalary region; distal third with small irregular maculations which are chiefly along the veins. Wings with the transverse bar bistre and situated in the middle, quite narrow as the width is not quite a third and a little more than a fourth of the width of the wing, caudad the band arches very slightly proximad and only slightly suffuses the caudal margin, the stigma broad and heavy and extending about half way to the base; distal section hyaline with the longitudinal veins broadly suffused with bistre toward the apex; proximal half primrose yellow. Cephalic and median limbs

ecru drab distinctly annulate with bistre. Caudal femora ecru drab with three distinct very dark bars and a solidly colored genicular region, the bars being paler laterad than dorsad, the pregenicular annulus ochraceous buff; caudal tibiæ rather dull citron yellow touched with spots of fuscous and with the genicular sections bistre and the tips of the spines blackish.

*Measurements.*

	♂	♀
Length of body, . . . . .	17 mm.	24 mm.
Length of pronotum, . . . . .	3.5 "	4.5 "
Length of tegmen, . . . . .	18.2 "	26 "
Length of caudal femur, . . . . .	9.2 "	12.5 "

A series of one male and two female paratypic specimens have been examined in addition to the types. The paratypic male has the markings slightly more subdued than in the male type. One of the female specimens is marked as in the male type with strongly contrasted colors, except that the tegmina have the bars somewhat obsolete and the anal area with the veins more strongly lined with dark. The remaining female specimen is colored much the same as the type, except that the bars of the tegmina are slightly less conspicuous.

The female type is slightly larger than the paratypic individuals of the same sex, while the additional male is slightly larger than the type.

This species was found in the arid valley of the Grand river near Antlers station, where the only vegetation was a heavy growth of low cactus interspersed with occasional sage. Specimens were by no means uncommon and could have been easily taken in numbers had the cactus not interfered so much with collecting, as when alarmed the individuals would invariably seek refuge in the dense beds of cactus. Orthoptera were not present in great numbers at this locality but the few species represented were quite interesting. The species *Æoloplus chenopodii* was the most abundant and most striking.

*Trimerotropis gracilis* (Thomas).

Antlers, Garfield Co., Colorado, Aug. 15, 3 ♀.

This very distinct species has been recorded from localities ranging from central Idaho to Salt Lake Valley and Colorado. Thomas has recorded it also from the northern boundary (49th parallel) of Montana and Dakota, and Scudder includes Nebraska in its range. Caudell has definitely recorded this species from Durango, Colorado, and Gillette credits it to nineteen localities in the same State, the most eastern

of which are Greeley and Pueblo, the majority being west of the divide.

This species was found among the cactus and sage in the dry bottom lands of the Grand river valley. The insects were by no means plentiful and were also extremely shy.

*Trimerotropis cineta* (Thomas).

Manitou, Colorado, 6,700–7,000 feet, Aug. 23, 11 ♂, 4 ♀.

The above series shows considerable variation in the strength of the median carina of the fastigium, some individuals having it strongly marked and in others it is hardly perceptible. The color of the caudal tibiae is quite variable in this species, as already noticed by McNeill, and the series in hand exhibits the following: ten with the distal three-fourths of the caudal tibiae greenish yellow, four with the same bluish green, and one red.

According to Gillette this species is found in the mountains and foothills of Colorado at altitudes ranging between 6,000 and 10,000 feet, and on both slopes of the divide. In his series of ninety-five specimens the hind tibiae were without exception bluish or yellowish on the distal portion. The species has been recorded from Nebraska, in addition to New Mexico and Colorado. The collection of the Academy contains specimens from Salida, Manitou Park and Fort Collins (Horse-tooth Mountain), Colorado.

This species was plentiful on a path among stunted pines on the upper slopes of the foothills back of Manitou. The location would have made it particularly difficult to capture specimens had not the individuals apparently trusted to their protective coloration. A close approach was necessary to cause them to take wing.

*Trimerotropis ferruginea* McNeill.

Daileys, Park Co., Montana, Aug. 4, 1 ♂. Sphinx, Park Co., Montana, Aug. 4, 3 ♂, 2 ♀. Spire Rock, Montana, Aug. 12, 1 ♂ ("on bare mountain"). Upper Geyser Basin, Yellowstone Park, Aug. 7, 4 ♂.

The specimen from Spire Rock is assigned to this species with considerable doubt, as it is larger and has a rather different facies, but does not appear to be any closely allied form. The males from Upper Geyser Basin appear rather different from the Daileys and Sphinx specimens, being a little smaller and more like the Spire Rock individual in their somewhat more robust form, though considerably smaller size. This species is probably little more than a form of *bifasciata*, and hardly worthy of a name in view of the great amount of individual variation found in most of the species of the genus.

This species was found in rather bare mountainous sections and on the formation about the larger Yellowstone geysers.

***Trimerotropis monticola* Saussure.**

Mammoth Hot Springs, Yellowstone Park, Aug. 5, 1 ♀. Summit of foothills, Mammoth Hot Springs, Aug. 5, 1 ♂.

These specimens agree quite well with Nebraska, Colorado and Wyoming specimens in the collection of the Academy. The specimens examined present considerable variation in the length of the tegmina.

This appears to be the first record of the species north of Colorado, except Tie-Siding, Wyoming, from which locality Gillette has recorded it.

These specimens were taken in the more hilly portions about the Mammoth Hot Springs, where, on account of the character of the country, they were captured with difficulty. The individuals fly swiftly and for long distances when alarmed.

***Trimerotropis praelara* McNeill.**

Grand Junction, Mesa Co., Colorado, Aug. 15, 5 ♂, 1 ♀.

This species has the fuscous band of the wing very broad, slightly more than one-third the length of the same, and well continued around on the caudal margin, while the spur is almost absent, the disk very pale greenish yellow, and the apex hyaline except for the infuscation of some of the veins.

The light base color is almost bone white in some specimens, and distinctly washed with rufous in others.

This species is known only from Salt Lake, Utah, and Sidney, Nebraska, in addition to the locality here given.

Among the bushes growing in the silt deposit along the banks of the Grand river these specimens were secured. The species was by no means as plentiful as *T. montana*, which was found in the same locality.

***Trimerotropis laticincta* Saussure.**

Colorado Springs, Colorado, Aug. 17, 6 ♂, 5 ♀. Knob Hill, Colorado Springs, Aug. 18-22, 7 ♂, 4 ♀.

This series exhibits considerable variation in the intensity of the bands of the tegmina, and in the shade of the light basic color. In some the latter is decidedly reddish, in others pale yellowish, and in the majority dull ochraceous. The caudal tibiae are more orange in some specimens than in others, and the pronotum varies from dull ferruginous through warm browns to dull olive, and in one specimen dull blackish-brown.

As far as can be determined from the material in hand Scudder's

*T. latifasciata* from Utah is the same as this, and his name would have precedence. However, as no Utah material is available I prefer to use Saussure's name, provisionally at least, for specimens from eastern Colorado.

The evidence given by Cockerell<sup>13</sup> regarding the difference in color characters of individuals of this species taken in coitu is especially interesting in view of the value which has been attached to the characters there mentioned, i.e., bands on the inner face of the caudal femora, and the width and curve of the wing band. Not much latitude is needed in these characters to connect forms like *laticincta* and *latifasciata* and *melanoptera*. Gillette does not consider *latifasciata* and *laticincta* separable from *T. citrina*.<sup>14</sup>

This species has been recorded from Fort Collins, Montrose, Grand Junction, Denver, Baileys and Golden, Colorado, by Caudell.

One of the more common of the larger prairie land species. The flight of this insect was less vigorous than is usual in species of the genus.

***Trimerotropis melanoptera* McNeill.**

Colorado Springs, Colorado, Aug. 18, 1 ♂. Knob Hill, Colorado Springs, Aug. 17 and 18, 2 ♂, 1 ♀. Prairie land, Colorado Springs, Aug. 18, 1 ♂.

Two of these specimens agree well in the color of the tegmina with a topotypic (Silver City) male, while three have the bars more prominent and contrasting with the lighter base color. The metazona of the pronotum is paler than the prozona in these three specimens, and in two of them the contrast is as great as in *T. monticola*. The black areas of the wings appear to be slightly less extensive than the specimens described by McNeill. The senior author's *T. snowi*<sup>15</sup> may prove to be but a form of this with a less extensive black area on the wings. From the material then in hand it appeared well worthy of separation, but the additional material shows variability which weakens its status.

This species was scarce even on the prairie land which appeared to be its favorite habitat. In habits it much resembled *T. laticincta*.

***Trimerotropis strenua* McNeill.**

Salt Lake City, Utah, Aug. 13 and 14, 4 ♂, 8 ♀.

This species is very close to *T. californica* Bruner, and probably

<sup>13</sup> *Proc. Davenport Acad. Sci.* IX, p. 38.

<sup>14</sup> *Bull. 94, Colo. Agr. Exp. Sta.*, pp. 35-36.

<sup>15</sup> *Trans. Kansas Acad. Sci.*, XIX, p. 223.



should be considered nothing more than a race of it. The bars of the tegmina are usually somewhat narrower and the caudal tibiae not quite so deep in color. The majority of the specimens have a more or less distinct ferruginous or ochraceous wash suffusing the tegmina, while several have the lighter sections without the same, and clear bone white in color as in the pair of *californica* used for comparison. A pair of specimens from Salt Lake Valley, received from Prof. Bruner, and labelled by him *T. praeclara*, belong to this species. Some of the specimens examined have the tegminal bars more distinct and less broken into spots than others, while the width also varies as much as the intensity. A female individual of this species from Salt Lake City, in the collection of the Academy,<sup>16</sup> has the tegminal bars much broken into annuli.

In nine of the specimens examined a second median bar on the lateral face of the caudal femora is more or less distinctly indicated, while in six it is absent or represented only by a very faint clouding.

This beautiful species was quite common in the arid sage-brush region on the outskirts of Salt Lake City and the series was taken with ease. In spite of the insect's bold coloring it was most inconspicuous when at rest.

***Trimerotropis montana* McNeill.**

Grand Junction, Mesa Co., Colorado, Aug. 15, 10 ♂, 4 ♀.

This species, if such it might be called, is very closely allied to the preceding, as has been stated by McNeill.<sup>17</sup> As far as the material in hand goes it appears to be only a more subdued form, with the dark tegminal bars broader and pale areas more ochraceous and in a measure lacking the strong contrast seen in *strenua*. The character of the median carina of the fastigium and the proportions of the pronotum do not differ from the series of *strenua*, while the lateral face of the caudal femora in the greater majority have a median band more or less faintly indicated in addition to the constant subapical one.

This species has been previously recorded from Durango and Delta, Colorado, in addition to Grand Junction, as well as Boise City, Idaho, the type locality.

These insects were taken on the banks of the Grand river, on ground that had been recently inundated. The soil was sandy and clusters of tall bushes grew here and there. The specimens were active and not taken without difficulty.

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<sup>16</sup> *Trans. Amer. Ent. Soc.*, XXVII, p. 333.  
*Proc. U. S. Nat. Mus.*, XXIII, p. 433.

***Trimerotropis salina* McNeill.**

Colorado Springs, Colorado, Aug. 17, 1 ♂. Knob Hill, Colorado Springs, Aug. 17, 3 ♀.

These specimens are slightly larger than the measurements given by McNeill, but we have placed them here chiefly on account of the poorly contrasted tegminal bars and the broad wing band. The lateral face of the caudal femora presents a median bar of varying intensity in several specimens. The coloration (*i.e.*, blackish bars and suffusion) of the ventral sulcus of the caudal femora appears to be too variable to be given the prominence assigned to it by McNeill. The male individual here studied would be placed in another section of the *viniculata* group on the femoral coloration, while it unquestionably is the same as the three females which have the coloration as described by McNeill. Instances such as this are by no means confined to this species, but can be found in most any large series of a species of the genus.

***Trimerotropis fratercula* McNeill.**

Daileys, Park Co., Montana, Aug. 4, 13 ♂, 6 ♀. Sphinx, Park Co., Montana, Aug. 4, 1 ♀. Fountain, Lower Geyser Basin, Yellowstone Park, Aug. 6, 6 ♂, 6 ♀. Upper Geyser Basin, Yellowstone Park, Aug. 7, 3 ♂, 4 ♀. Mud Volcano, Yellowstone Park, Aug. 10, 1 ♂. Emerald Spring, Yellowstone Park, Aug. 7, 1 ♀. Yellowstone Lake, Yellowstone Park, Aug. 7 and 10, 1 ♂, 1 ♀.

This series is assigned to this species with some little doubt. Some affinity exists with *T. inconspicua* Bruner, at least as far as published diagnostic characters are concerned. The coloration of the ventral sulcus of the caudal femora varies in individuals from the same locality and not separable by any other character. Some present a solid blackish sulcus with a distinct light pregenicular annulus, others have a well-marked additional light median bar, and a number of specimens have the black interrupted on the sides of the sulcus but undivided in the middle. The evidence of this series of forty-three specimens of unquestionably but one species is that the coloration of the sulcus of the caudal femora is of little or no diagnostic importance. The coloration of the lateral and internal faces of the caudal femora are also unstable, in the authors' opinion, while the intensity of the tegminal bars and the width of the wing bars are by no means as stable as would be supposed from the importance given them as diagnostic characters.

The series studied presents some variation in size, the males from Fountain being somewhat larger than males from Daileys (length including tegmina: Fountain 28.5 mm., Daileys 25), while the Mud

Volcano and Upper Geyser Basin males are slightly smaller than the Daileys specimens (24 mm.). The females appear to be rather uniform in size. Three of the four females from Upper Geyser Basin are suffused with rufescent, while the other female and three males from the same locality are without any suffusion. The females from Fountain have the colors more contrasted than the majority of the Daileys females, while the Emerald Spring female has the contrast just as great. The males from Fountain have the pale tints more grayish and less ochraceous than in the Daileys males.

The species was so abundant about Daileys that during the brief stop of the train nineteen specimens were easily taken. This was also the most abundant species of Orthoptera found about the geyser formations of the Park. The insects are wary and rise on the wing with speed. The coloration of the individuals almost invariably blended exactly with the soil on which they were found.

*Trimerotropis vinculata* Scudder.

Electric, Park Co., Montana, Aug. 4, 1 ♂. Muir, Bozeman Tunnel, Montana, Aug. 12, 1 ♀. Whitehall, Jefferson Co., Montana, Aug. 12, 1 ♂, 3 ♀. Upper Geyser Basin, Yellowstone Park, Aug. 7, 1 ♀. Salt Lake City, Utah, Aug. 14, 1 ♀. Antlers, Garfield Co., Colorado, Aug. 15, 1 ♂. Debeque, Mesa Co., Colorado, Aug. 15, 1 ♂. Austin Bluffs, Colorado Springs, Colorado, Aug. 18, 2 ♀. Manitou, Colorado, 6,700-7,000 feet, Aug. 23, 4 ♂, 4 ♀. Garden of the Gods, Colorado, Aug. 19, 2 ♀.

This series represents a great and interesting amount of variation even for this plastic species. Variation in size is considerable, the largest males being from Electric, Debeque and Manitou, the smallest from Antlers; the largest female from Salt Lake City, the smallest from Austin Bluffs. These differences in size appear to be individual, as the smallest male (Antlers) is from the same general region as the largest (Debeque). The specimens from Muir and Whitehall, Montana, are large, of rather uniform size, and but little smaller than the large Salt Lake City individual.

In coloration we find such variation that a detailed account may be of interest. The Electric specimen has the bands solid and the lighter colors hoary and sharply contrasted; the Muir and Whitehall representatives are quite dull, the Muir specimen almost blackish, while the bands are only moderately distinct, in one of the Whitehall individuals broken up into annuli. The Muir and Whitehall type has the pronotum with little contrast, and the caudal femora less variegated than in the Electric individual. The Yellowstone specimen is overcast with

dull hoary, the bands very weak, narrow and broken into annuli, the whole insect being much duller and more inconspicuous than the usual type. The Salt Lake City female has the bands of about average width, but weak and rather broken. Antlers and Debeque specimens are of the type which might be called normal or typical, with the bands distinct, broad and solid, and the lateral lobes of the pronotum moderately variegated. Austin Bluffs specimens are overcast with reddish ochraceous, one with the bands more distinct and solid than the other; Manitou individuals overcast with dull red, the bands variable in intensity and solidity, but not in width, one specimen having the bands quite blackish. The Garden of the Gods specimens are particularly interesting, being entirely washed with brick red, the tegminal bands distinct but narrower than usual.

The Garden of the Gods specimens are very interesting as the suffusing tint is the predominating color of that region, and in line with this one would expect a uniform very pale type from strongly alkaline regions, which does not hold true of the large amount of material of this species seen. Series from San Diego, California, one of the original localities; Alamogordo, New Mexico, and Quartzsite, Arizona, are extremely variable among themselves, and each exhibit extremes as different, or nearly so, as those in the material here treated. However, no specimens quite as reddish as the Garden of the Gods individual have been seen from other localities. The band of the wing is quite narrow and weak in some of the Manitou specimens,<sup>18</sup> and heavy in Whitehall and Muir individuals.

The species was generally distributed and equally abundant in the localities in which it was collected. The specimens taken about the Garden of the Gods showed remarkable protective coloration, as all were overcast with brick red which blended exactly with the characteristic brick red formation of the Garden. This was the only species found on these outcroppings.

***Trimerotropis coerulescens* Bruner.**

Salt Lake City, Utah, Aug. 13, 2 ♂, 1 ♀. Top of Ensign Peak, Salt Lake City, Utah, Aug. 13, 1 ♂, 2 ♀.

These specimens of this beautiful species have the tegminal bars uniform in pattern and varying but slightly in intensity, except in the female from Salt Lake City in which they are quite dark. The coloration of the ventral sulcus of the caudal femora varies from black with two light bars in the distal half to but one bar in the region, while in

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<sup>18</sup> These may possibly represent one of the other species of the *vinculata* group.

several specimens the evanescent bar (proximal) is present but incomplete. The coloration of the caudal tibiae varies from the usual light tint to a dark glaucous blue. The size of the specimens is quite uniform.

This species has been recorded from Washington (Yakima), Oregon, (Umatilla), Idaho, Montana, Wyoming, Utah and Los Angeles, California.

This species was found in the same locations as *T. cyaneipennis*, which species it much resembled in habits.

*Trimerotropis cyaneipennis* Bruner.

Salt Lake City, Utah, Aug. 13, 4 ♂, 4 ♀. Foothills, Salt Lake City, Utah, Aug. 14, 3 ♂, 2 ♀.

This series is quite uniform in size, while variation in coloration is chiefly due to the intensity of the broken tegminal bars, though one specimen from Salt Lake City is uniformly very pale with most of the markings almost obsolete.

This species has been recorded from the Salt Lake Valley region, and from Grand Cañon, Flagstaff and Prescott, Arizona. The two males recorded from Prescott are very considerably darker than any of the Salt Lake Valley specimens examined.

This species was somewhat common but inhabited the most inaccessible portions of Ensign Peak, and owing to the rapidity of its flight specimens were taken with no little trouble.

**CIRCOTETTIX** Scudder.

*Circotettix carlinianus* (Thomas).

Mammoth Hot Springs, Yellowstone Park, Aug. 5, 1 ♀.

*Circotettix undulatus* (Thomas).

Manitou, Colorado, 6,400 and 6,700 feet, Aug. 23, 1 ♂, 1 ♀. Pike's Peak, Mountain View, 9,700 feet, Aug. 20, 1 ♂, 1 ♀. Cripple Creek, Teller Co., Colorado, Aug. 19, 4 ♂.

These specimens have been compared with a series of twenty specimens from localities in the mountain regions of New Mexico, and one from Utah. Manitou individuals are more reddish than those from the other localities.

This species was nowhere abundant, but several specimens were found on the tailings about Cripple Creek mines.

*Circotettix rabula*<sup>10</sup> n. sp.

Types: ♂ and ♀; summit of hill at head of springs, Mammoth Hot

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<sup>10</sup> I.e., a jangling fellow.

Springs, Yellowstone National Park, Wyoming; altitude 7,000 feet, Aug. 5, 1904. (M. Hebard.) [Hebard Collection.]

Allied to *C. undulatus* (Thomas) and *shastanus* Bruner, but differing from the former in the more robust form, the broader head, broader heavier and less strongly sulcate frontal costa, larger eyes, slightly less angulate caudal margin of the pronotum and in details of the coloration, as the lighter and usually more variegated tegmina and pronotum and the less distinct fuscous band and spur of the wing. From *shastanus* it appears to differ in the heavier form and the structure of the first subjacent radial vein.

The form of the wing of this species is essentially that of *C. undulatus*, and its closest relationship appears to be with that species. As *shastanus* is not available for study, comparison can only be made with descriptions, but the results of such comparisons seem sufficient to separate the specimens in hand, especially when we consider the peculiar structure of the first subjacent radial in the older species, while in the new one here treated the structure of that region does not differ materially from the type seen in *undulatus*.

In coloration a number of specimens of this species bear a striking superficial resemblance to *C. carlinianus*.

Size medium; form quite robust; surface finely rugulose. Head with the occiput gently but distinctly arched, the interocular region no more elevated than the summits of the eyes and in width but little less than the length of the eye; fastigium slightly declivent, forming an obtuse angle with the face, nearly as wide as long, shallow, with the median carina rather faint and the marginal carinae but little more distinct; frontal costa broad, expanded between the antennae and moderately constricted immediately ventrad of the ocellus, margins carinate and nearly (♂) or not (♀) reaching the clypeal margin, broadly sulcate ventrad of the ocellus particularly in the male, strongly punctate dorsad with a depressed area at the junction with the fastigium; eyes moderately prominent, rather small, very broad ovoid in shape; antennae slightly longer than the head and pronotum together, somewhat depressed in the proximal section. Pronotum deplanate dorsad, broad, distinctly expanded caudad; cephalic margin very broadly and obtusely angulate; caudal margin rectangulate in the male, obtuse-angulate in the female, the angle finely formed and little rounded in either sex; lateral angles rounded and hardly marked on the prozona, distinct and heavy shoulders present on the metazona; median carina fine, little elevated, depressed at the principal sulcus, prozona about half the length of the metazona; lateral lobes slightly

deeper than long, considerably impressed mesad, ventro-caudal angle rounded. Tegmina rather broad, the greatest width contained slightly more than four times in the length; costal lobe very slight and low, sutural margin straight, apex obliquely truncate toward the sutural margin, the distal third of the costal margin arcuate, making the immediate apex rounded rectangulate; intercalary vein distinct, intermediate in position proximad, close to the median vein distad. Wings moderately falcate, broad, the breadth being contained about once and a half in the length; humeral field with the apex rounded acute-angulate; axillary field with the margin very slightly arcuate and not lobate, being no more prominent than the next area in the radiate field; posterior axillary vein with its ramus paralleling closely the anterior axillary vein for a considerable distance, but not coalescing with it; radiate veins moderately thickened. Caudal femora rather slender, the ventral carina distinctly but slightly produced arcuate; caudal tibiae with nine spines on the lateral margins.

General color ecru drab, sprinkled, spotted and blotched with drab; eyes burnt umber; antennae of the paler color annulate with bistre; dorsum of the pronotum and the lateral lobes marked with the darker color. Tegmina with traces of three bands of quadrate and ocellate spots, these spots being almost wholly formed by the infuscation veins and cross veins, the bands being proximad, proximo-mesad and disto-mesad, while the distal third is supplied with scattered quadrate ocelli of the darker color. Wings with the transverse band very weak and almost severed, being chiefly an infuscation of veins and without definite limits, extending caudo-mesad and with a broad, moderately distinct stigma which extends half way to the base, the color of the band and stigma being drab; distal portion hyaline except for infusate veins, proximal portion citron yellow. Cephalic and median limbs of the general colors annulate; caudal femora with a pale pregenicular annulus, and with traces of two transverse bars which are more distinct dorsad; caudal tibiae pale, infusate proximad and distad, the spines touched apically with blackish.

*Measurements.*

	♂	♀
Length of body, . . . . .	27.5 mm.	29.7 mm.
Length of pronotum, . . . . .	6.4 "	6 "
Length of tegmen, . . . . .	29.5 "	28.7 "
Length of caudal femur, . . . . .	13 "	13.2 "

A series of ten specimens in the Hebard Collection have been examined in addition to the types: five, two males and three females,

from the type locality and date but taken on geyser formation at the upper end of the springs, one male from the immediate vicinity of the Hot Springs, August 5, another male from the summit of the first foothill of the Gallatin Range at the type locality, August 5, and one

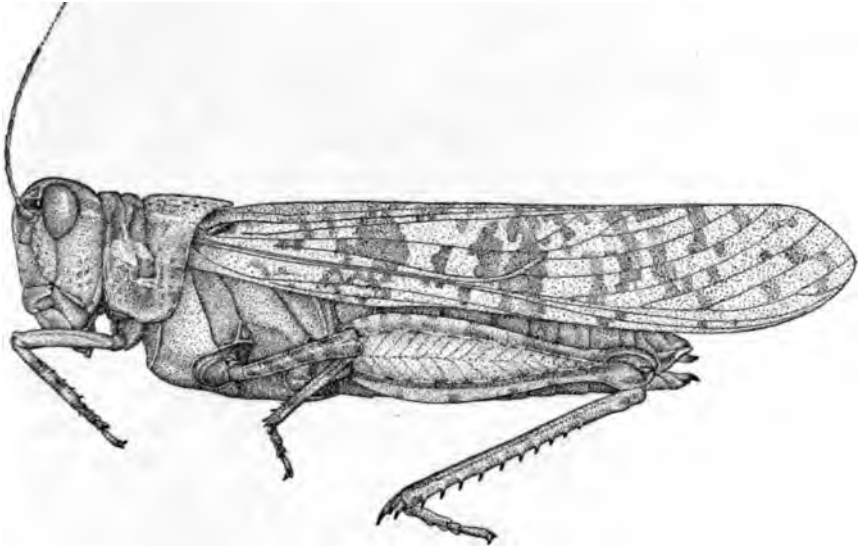


Fig. 13.—*Circolettix rabula* n. sp. Mammoth Hot Springs, Yellowstone Park. Lateral view of female type. ( $\times 3$ .)

female from Spire Rock, Montana, August 12. These specimens vary slightly in the strength of the tegminal bars, which are partially solid in some specimens, but all other characters appear to agree well with the types.

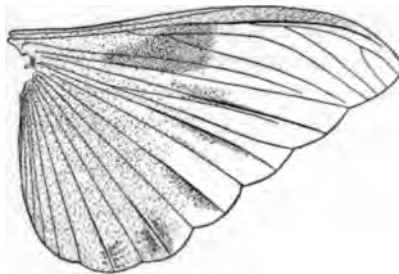


Fig. 14.—*Circolettix rabula* n. sp. Wing. ( $\times 2$ .)

Two males and two females received from Prof. Gillette and labelled *C. verruculatus* are referable to this new form. They are from Dutch George's and Virginia Dale, Larimer Co., Colorado.

This species was by no means plentiful about the Hot Springs and much time was occupied in collecting the ten specimens. The insects are most swift and shy, so that great difficulty was experienced in



approaching them close enough to strike with the net. They may be heard high in the air making for several minutes at a time a noise like the whirring of machinery. The sound is continuous while the insects rise and fall in a most peculiar erratic flight. I have seen specimens of this species fly for over a quarter of a mile making continually this peculiar sound. Of all the Orthoptera met with this was without doubt the most vigorous and elusive species.

*Cirootettix suffusus* (Scudder).

Summit of foothill of Gallatin Range, Mammoth Hot Springs, Yellowstone Park, Aug. 5, 1 ♀. Hill at head of springs, Mammoth Hot Springs, Aug. 5, 1 ♂. Upper Geyser Basin, Yellowstone Park, Aug. 5, 6 ♂, 2 ♀, 1 nymph.

These specimens are rather uniform in color for representatives of this genus, one being more clear grayish than the others, and several with a faint suggestion of ferruginous in their general tone.

About the Hot Springs this species was found in the open sagebrush of the hillsides, while at the Upper Geyser basin it was found in the small grassy openings in the dense pine woods.

*Cirootettix verruculatus* (Kirby).<sup>20</sup>

Muir, Bozeman Tunnel, Gallatin-Park Co., Montana, Aug. 12, 1 ♂, 1 ♀.

These specimens do not differ in size, the female, however, being slightly more robust. The frontal costa in the male is quite broad and similar to the female, thus differing from a large number of Eastern specimens examined. A series of thirty-one specimens, covering localities extending from the mountain regions of Pennsylvania and Maine west to the northern peninsula of Michigan (Pequaming), shows that while considerable variation in color and size is present in a series, it cannot well be correlated with locality. The two Montana specimens are among the largest seen.

These two specimens were taken on a cinder pile beside the railroad. Their crackling was very noticeable whenever they took flight.

**HADROTETTIX** Scudder.

*Hadrotettix trifasciatus* (Say).

Sappington, Gallatin Co., Montana, Aug. 12, 1 ♂. Colorado Springs,

<sup>20</sup> The type of this species was taken in "Latitude 57° N.," and in all probability was collected by Drummond, who traversed the Athabasca and Peace river region in this latitude in western Athabasca and northeastern British Columbia. If collected by Richardson, the other naturalist of the Franklin expedition, it was no doubt taken either in the vicinity of York Factory, Keewatin or on the Athabasca river south of Lake Athabasca.

Colorado, Aug. 17, 2 ♂. Knob Hill, Colorado Springs, Aug. 17 and 18, 4 ♂, 6 ♀. Prairie land, Colorado Springs, Aug. 18, 7 ♂, 10 ♀.

These specimens exhibit considerable variation in the intensity and width of the bands of the tegmina in the female, some having them very weak and broken up into spots, while a few have them as distinct as in the males. The males are quite uniform in the coloration of the tegmina, both in width of bars and intensity.

This species was quite common on the prairie. The flight is slow and specimens may be easily captured even without a net.

**BRACHYSTOLA** Scudder.

*Brachystola magna* (Girard).

Colorado Springs, Colorado, Aug. 18, 9 ♂, 4 ♀, 1 nymph. Knob Hill, Colorado Springs, Aug. 17, 5 ♂, 1 nymph. Prairie land, Colorado Springs, Aug. 18 and 19, 2 ♂, 6 ♀, 1 nymph.

This series of thirty specimens clearly shows that the species has two color phases and that the green phase should not be confused with Charpentier's *B. virescens*, a Mexican species of a quite distinct character, as an examination of his plate will show. Of the series examined eight are of the brown phase and twenty-one of the green, while one is too discolored to determine its true color. The green specimens vary considerably in the shade of the green, but the males appear to have the richer coloration.

There is considerable variation in the size of the males.

The following color description is made from a female specimen in the green phase from Colorado Springs received alive in Philadelphia and carefully stuffed after death, to-day presenting the same coloration as in life.

Predominating color oil green. Head dark oil green above becoming paler ventrad on the face and genæ, the caudal margin of the genæ, the mandibles and broad band extending from cephalad of the eye ventrad to the clypeal sulcus and the lateral portions of the clypeus pale flesh color; eyes clay color sprinkled with bistre; antennæ dusky, margined laterad in the proximal section with pale greenish. Pronotum with the lateral and median carinæ marked with very dark French green, on the metazona extending slightly ventrad and somewhat suffusing the lateral lobes; lateral carinæ bordered mesad by a line of pinkish vinaceous; recurved caudal and lateral lobe margins chiefly flesh color. Tegmina tawny ochraceous with fair-sized bistre spots well distributed over them. Abdomen suffused with bistre dorsad; a pair of rather broad distinct longitudinal lines, one on each side of the median carina, and a transverse series of spots on the caudal

margin of each segment, vinaceous. Venter bone white. Cephalic and median limbs bone white washed with greenish. Caudal femora oil green dorsad, whitish ventrad, the ventro-lateral sulcus with quadrate touches of vinaceous-rufous, while the internal face is suffused with the same color, a median line of French green is present on the lateral face and one of brick red on the internal face, genicular region bluish green dorsad, with a proximal transverse blackish bar ventrad, the arches chestnut; caudal tibiæ lavender laterad, vinaceous internally, the genicular region bluish, the spines bone white tipped with black.

This species was by no means abundant, but in the prairie region specimens would every now and then be found. The insects were so awkward that they seemed to have almost no control over their movements. Their coloration, however, undoubtedly proves a great protection to them.

#### LOCUSTINÆ.

##### *PAROPOMALA* Scudder.

##### *Paropomala wyomingensis* (Thomas).

1871. *Mesops wyomingensis* Thomas, Proc. Acad. Nat. Sci. Phila., 1871, p. 152. [Along the east base of the Black Hills, in the vicinity of Cottonwood Creek, Fall River Co., South Dakota, or Converse Co., Wyoming.]

1890. *Mesops cylindricus* Bruner, Proc. U. S. Nat. Mus., XII, p. 48. [Valentine, Nebraska, along the north side of Keya Paha creek, also on the bluffs south of Chadron, Nebraska.]

Roggen, Weld Co., Colorado, Aug. 24, 6 ♂, 1 ♀.

As far as can be determined from the material in hand, including specimens determined by Bruner as both *wyomingensis* and *cylindricus*, and the literature bearing on the subject, no reason is apparent for separating the two above-mentioned forms. Bruner's *cylindricus* was based on the brown phase, while in addition to the coloration larger size was given as a differential character. This latter would appear to be purely an individual matter, as green specimens have been examined nearly as large as Bruner's measurements of that sex in *cylindricus*. All the Roggen males are in the brown phase, and the single female in the green.

Material has also been examined from Valentine and Haigler, Nebraska, and Denver and Greeley, Colorado.

These specimens were beaten from some very tall weeds near the railroad track, while the train was making a brief stop.

##### *SCHISTOCERCA* Stål.

##### *Schistocerca lineata* Scudder.

Brush, Morgan Co., Colorado, Aug. 24, 1904, 1 ♂.

This individual is much smaller than the males measured by Scudder. Gillette<sup>21</sup> has called attention to the variation in size in this species.

Beaten from thicket of weeds.

**HESPEROTETTIX** Scudder.

***Hesperotettix viridis*** (Thomas).

Knob Hill, Colorado Springs, Colorado, Aug. 18, 1 ♀. Prairie land, Colorado Springs, Aug. 18, 1 ♂, 2 ♀. Hill near cog-road station, Manitou, Colorado, Aug. 16, 2 ♀.

These specimens vary considerably in size, the Manitou females being larger than any of the others, and similar to two from Arizona and New Mexico, while seven specimens from five other Colorado localities are in size about equal to the Colorado Springs individuals. The coloration varies very little, and then only in the intensity of the blackish head and pronotal markings.

This species was found distributed over a considerable region, but was in no place common.

***Hesperotettix festinus*** Scudder.

Salt Lake City, Utah, Aug. 13 and 14, 10 ♂, 11 ♀. Hillside at Salt Lake City, Aug. 14, 1 ♂, 1 ♀. Top of Ensign Peak, Salt Lake City, Aug. 13, 2 ♂, 2 ♀.

This series as a whole has shorter wings than nine individuals from southern Arizona, and in consequence of this the specimens appear somewhat more robust. The variation in size in the females is considerable, the larger type greatly predominating, while the males vary appreciably. The coloration tends in some specimens toward brownish and in a few is distinctly brown. This is also true of a male Salt Lake City specimen<sup>22</sup> which has been in the Academy collection quite a time.

This species was by far the most plentiful of the genus *Hesperotettix* which I found, and individuals were quite common in the sage growing from the foot to the top of Ensign Peak. Individuals of the species were very active, but relied chiefly for protection on their jumping ability, which was very considerable.

***Hesperotettix gillettei*** Bruner.<sup>23</sup>

Newcastle, Garfield Co., Colorado, Aug. 15, 1 ♀.

This recently described species is only known from the Grand river drainage.

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<sup>21</sup> Bull. 94, Colo. Agric. Exp. Sta., p. 38.

<sup>22</sup> July 24, 1898.

<sup>23</sup> *Hesperotettix Gillettei* Bruner, Bull. 94, Colo. Agr. Exp. Sta., p. 61, 1904. [Rifle, Glenwood Springs, Delta and Grand Junction, Colorado.]

During a brief stop of the train at Newcastle, I succeeded in capturing a single specimen of this species in the dust beside the railroad track.

***Hesperotettix speciosus* (Scudder).**

Akron, Washington Co., Colorado, Aug. 24, 1 ♂.

The median carina of the pronotum of this specimen is deep maroon purple, which depth of coloration is almost equalled in a male from Rocky Ford, Colorado.

The specimen was beaten from tall weeds.

***Eoloplus* Scudder.**

***Eoloplus regalis* (Dodge).**

Fort Morgan, Morgan Co., Colorado, Aug. 24, 1 ♂.

A single specimen was beaten from low bushy weeds growing densely about a water tank. Vigorous beating for several minutes failed to produce other specimens.

***Eoloplus chenopodii* (Bruner).**

Antlers, Garfield Co., Colorado, Aug. 15, 11 ♂, 14 ♀.

This series varies considerably in the intensity of the coloration, some individuals being more ashy than others.

The specimens were easily taken in spite of the cactus, in which they invariably sought refuge, for their movements were slow and they could jump but a short distance. The species was abundant.

***Bradynotes* Scudder.**

***Bradynotes obesa* (Thomas).**

Summit of first foothill behind hotel, Mammoth Hot Springs, Yellowstone Park, Aug. 5, 1 ♀. Top of bare hill opposite Devil's Kitchen, Mammoth Hot Springs, Aug. 5, 1 ♂, 2 ♀.

Although much time was spent searching carefully for specimens of this species, two days' collecting resulted in but four specimens being found. All were taken on the gravelly tops of the foothills where vegetation was almost absent. Their color blended perfectly with the soil and they appeared to rely on this as a means of protection.

***Podisma* Latreille.**

***Podisma dodgei* (Thomas).**

Pike's Peak, Colorado, at elevations of 9,700 (Mountain View) and 10,200 feet, Aug. 20, 2 ♂, 1 ♀.

These specimens and the specimen of *Hippiscus altivolus* were the only Orthoptera seen in the rather barren tract of stunted aspen

above the railroad pumping station. This species seemed to be strictly terrestrial in habitat.

*Podisma oreas*<sup>24</sup> n. sp.

Types: ♂ and ♀; summit of foothill of Gallatin Range, Mammoth Hot Springs, Yellowstone National Park, Wyoming. Altitude, 7,000 feet. Aug. 5, 1904. [Coll. Morgan Hebard.]

Closely allied to *P. ascensor* Scudder from American Fork Cañon, Utah, agreeing almost perfectly in the form of the abdominal appendages and other characters, but differing in the vertex being somewhat elevated, the interspace between the eyes in the male over twice as broad as the first antennal joint, the frontal costa more sulcate, the size slightly larger, the antennæ reddish and the caudal tibiæ differently colored.

Size medium (for the genus). Head with the occiput rounded and distinctly elevated above the pronotum in the ♂, hardly elevated in the ♀; fastigium moderately declivent, very shallowly and broadly excavated, interspace between the eyes in both sexes over twice as wide as the proximal joint of the antennæ; frontal costa broad, hardly (♂) or very slightly (♀) narrower than the interspace between the eyes, slightly depressed around the ocellus, not sulcate, biseriate punctate dorsad; antennæ rather short, defective in the ♂, distinctly but not considerably longer than the pronotum in the ♀; eyes hardly prominent, truncate cephalad, distinctly longer than the infraocular sulcus. Pronotum very slightly inflated, very slightly tectate, metazona finely punctate; cephalic margin subtruncate, caudal margin very slightly arcuate, no distinct lateral carinæ but shoulder angles moderately prominent caudad; prozona slightly longer than the metazona in both sexes, quadrate in the ♂, slightly transverse in the ♀, principal transverse sulcus very well marked, median carina more distinct on the metazona than cephalad, but not markedly elevated anywhere in its length; lateral lobes distinctly longer than broad. Tegmina slightly less than the pronotum in length, sublanceolate, twice as long as broad in the ♂, half again as long as broad in the ♀, apex narrowly rounded, tegmina well separated dorsad. Abdomen with the apex but little elevated and not at all recurved; furcula about a third the length of the supra-anal plate and distinctly longer than the segment from which they spring, simple, parallel; supra-anal plate produced trigonal, considerably inflated mesad, median sulcation and bordering ridges distinct on the proximal half, the sulcation obsolete distad;

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<sup>24</sup> 'Ορεας, in allusion to its habitat.

cerci slender, strongly tapering in the proximal half, very slightly tapering in the distal half, apex blunt and very slightly excavated and falling considerably short of the apex of the supra-anal plate; sub-

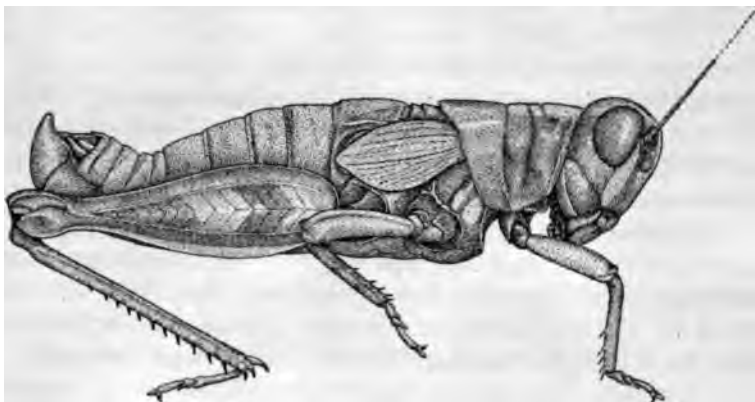


Fig. 15.—*Podisma oreas* n. sp. Mammoth Hot Springs, Yellowstone Park. Lateral view of male type. ( $\times 4$ .)

genital plate with the apical margin slightly elevated, the whole plate evenly tapering to this section, which is narrowly subtruncate and with a slight depressed area immediately caudad of the margin. Prosternal spine erect, slightly retrorse, thick and rather blunt. Interspace between the mesosternal lobes distinctly broader than long in the  $\sigma$ , over half again as broad as long in the  $\phi$ ; metasternal lobes sub-attingent in the  $\sigma$ , separated by a subquadrate interspace in the  $\phi$ . Median and cephalic limbs no more inflated in the  $\sigma$  than in the  $\phi$ . Caudal limbs moderately robust, femora reaching to the apex of the abdomen; caudal tibiae with eleven spines on each margin.

General color bistre in the  $\sigma$ , burnt umber in the  $\phi$ . Postocular streak rather faint and weak, seal brown in color; antennae carmine, rather dull distad. Tegmina in the  $\sigma$  darker ventrad than dorsad, unicolorous in the  $\phi$ . Stripes on the pleura distinct. Caudal femora with indications of two dark bars, chevron-shaped on the faces, the light color being an ecru drab, genicular arches and proximal section of the lobes on the internal face blackish, ventral face canary yellow, duller in the male than in the female; caudal tibiae very dull olive green in the  $\sigma$  and ochraceous in the  $\phi$ , except the dorsal face which is gamboge yellow in both sexes; spines black.



Fig. 16.—*Podisma oreas* n. sp. Dorsal view of apex of male abdomen. ( $\times 4$ .)

*Measurements.*

	♂	♀
Length of body, . . . . .	20 mm.	23 mm.
Length of pronotum, . . . . .	4.8 "	5.5 "
Length of tegmen, . . . . .	4 "	5 "
Length of caudal femur, . . . . .	10.5 "	12 "

The type specimens are unique.

These two specimens were taken on the pebbly summit of the foothills back of the Mammoth Hot Springs Hotel. The ground in this region was quite bare, but few plants being noticed.

***Podisma oregonensis* (Thomas).**

The following localities are represented, all in Yellowstone Park:

Mammoth Hot Springs, Aug. 5, 4 ♂, 1 ♀. Summit of first foothill of Gallatin range, Mammoth Hot Springs, Aug. 5, 4 ♂, 8 ♀. Continental Divide near 8,300 feet elevation (alpine meadow), Aug. 7, 1 ♂. Apollinaris Spring, Aug. 6, 1 ♀. Yellowstone Lake, Aug. 7, 8 ♂, 7 ♀. Near Grand Cañon, Aug. 10, 10 ♂, 4 ♀.

The specimens from the higher altitudes, as the Continental Divide and Grand Cañon representatives, average smaller than the individuals from lower altitudes. One male from Mammoth Hot Springs is partially covered with geyser deposit and is larger than any representative of the same sex (♂) seen. In coloration some specimens have the paler markings more brilliant than in others, and some few individuals from Grand Cañon are suffused with smoky brown.

This species appeared to be widely distributed and was found quite plentiful in the short grass of all the elevated open lands in the Park. The species was strictly terrestrial, and individuals were invariably active and possessed of considerable saltatorial power.

**MELANOPLUS Stål.*****Melanoplus lakinus* (Scudder).**

Knob Hill, Colorado Springs, Colorado, Aug. 17 to 22, 6 ♂, 4 ♀. Prairie land, Colorado Springs, Aug. 18, 1 ♂, 1 ♀. Fort Morgan, Colorado, Aug. 24, 11 ♂, 8 ♀. Akron, Colorado, Aug. 24, 2 ♂.

Several of the above specimens belong to the richly colored green phase described by Gillette.

In all the localities in which I collected on the Colorado prairie where the vegetation was high and rank, I found this beautiful species in moderate numbers. The individuals were very active, but could be easily beaten from the weeds in which they had taken refuge. The green form was noticeable for its brilliancy.

***Melanoplus occidentalis* (Thomas).**

Emigrant, Montana, Aug. 4, 1 ♂, 2 ♀. Knob Hill, Colorado



Springs, Colorado, Aug. 17 to 22, 7 ♂, 11 ♀. Austin Bluffs, Colorado Springs, Aug. 18, 1 ♀. Prairie land, Colorado Springs, Aug. 18, 4 ♂, 5 ♀. Garden of the Gods, Manitou, Colorado, Aug. 17, 2 ♂, 8 ♀. Pike's Peak, Colorado, Aug. 20, 1 ♂ at Mountain View, 9,700 feet, 1 ♀ at 10,100 feet, 1 ♀ at Middle Hudsonian, 10,500 feet.

The specimens here recorded from Emigrant, Montana, are, as far as known, the most northern definite record except one from Bismarck, North Dakota. The species has been recorded by Gillette from localities up to an altitude of 8,000 feet, and in view of the Pike's Peak records here given it will be seen to extend to an elevation of at least 10,500 feet, and to be truly an alpine species. In size these Pike's Peak individuals do not appear appreciably smaller than specimens from the vicinity of Colorado Springs, and are considerably larger than others from Durango, Colorado.

From the material collected this species appears to frequent a variety of habitats, from a distinctly arid region at Emigrant to a grassy gully in the Garden of the Gods. On the whole this form frequented the more sterile sections of the regions in which it was collected.

***Melanoplus flabellifer* Scudder.**

Knob Hill, Colorado Springs, Colorado, Aug. 18, 2 ♂. Garden of the Gods, Manitou, Colorado, Aug. 17, 4 ♂.

These specimens are identical with Scudder's *flabellifer* in the form of the cerci, but the validity of the species is, in the authors' opinion, questionable. As Gillette has shown,<sup>25</sup> a large series of specimens will contain forms referable to true *occidentalis*, *flabellifer* and *cuneatus*, and have a number of intermediates between these types as well. A number of the specimens referred in this paper to *occidentalis* are not typical of it, but were placed there as it is the older species and has priority over *flabellifer* in case the latter is synonymized. This action appears to us to be inevitable, but the material at hand is not extensive enough to take such action. No specimens of the *cuneatus* type are in the series.

The specimens of this species were taken in the same localities as *M. occidentalis*.

***Melanoplus bowditchi* Scudder.**

Grand Junction, Mesa Co., Colorado, Aug. 15, 3 ♂. Newcastle Garfield Co., Colorado, Aug. 16, 2 ♂.

These specimens are quite peculiar in appearance and not at all

<sup>25</sup> Bull. 94, Colo. Agr. Exp. Sta., pp. 53-54.

similar in coloration to individuals from eastern Colorado and Nebraska. The coloration is decidedly brown, sometimes gray brownish, and little yellow or clear gray is apparent. The head and pronotum are sprinkled with fine umber dots, and the tegmina have distinct quadrate maculations. The length of the body ranges from 17.5 to 19.5 millimeters.

All of the specimens of this species were found in the valley of the Grand river. Those taken at Grand Junction were found on silt near the river, where very little vegetation was to be seen. The insect's coloration was extremely protective and the species relied almost entirely on its wings for locomotory power.

***Melanoplus flavidus* Scudder.**

Knob Hill, Colorado Springs, Colorado, Aug. 17-22, 21 ♂, 10 ♀. Prairie land, Colorado Springs, Aug. 18, 4 ♀. Garden of the Gods, Manitou, Colorado, Aug. 17 and 19, 1 ♂, 1 ♀.

This series shows considerable variation in size and color, the latter chiefly in varying intensity of the pattern.

This species was found in the same situations as *M. occidentalis*, but in much greater numbers.

***Melanoplus sanguineus* Bruner.**

Garden of the Gods, Colorado, Aug. 17, 1 ♂, 1 ♀.

This striking and beautiful species was recently described from Lamar and Las Animas, in the prairie section of the Arkansas valley, Colorado. This record shows it ascends well into the foothills.

The coloration of the caudal femora and tibiae is very striking and serves to readily identify the species. The female specimen in hand has the head, caudal section of the disk of the pronotum and the dorsal face of the caudal femora somewhat suffused with greenish.

The specimens were taken in the high grass of a meadow at the western entrance to the Garden of the Gods.

***Melanoplus bruneri* Scudder.**

Old Faithful Geyser, Upper Geyser Basin, Yellowstone Park, Aug. 7, 1 ♂.

This single specimen was taken in a small grassy field in the dense pine woods back of Old Faithful Inn.

***Melanoplus intermedius* Scudder.**

Sphinx, Park Co., Montana, Aug. 4, 1 ♂. Sappington, Gallatin Co., Montana, Aug. 12, 1 ♂. Geyser formation, Mammoth Hot Springs, Yellowstone Park, Aug. 5, 1 ♂. Salt Lake City, Utah, Aug. 13, 6 ♂, 3 ♀. Top of Ensign Peak, Salt Lake City, Aug. 13, 5 ♂, 2 ♀. Newcastle, Garfield Co., Colorado, Aug. 16, 1 ♂.

The form of the cerci of the male individuals here placed under this species agree fairly well with Scudder's figure of those parts, and notwithstanding his remarks to the contrary the authors believe *intermedius* is at the most not more than a form of *atlanis*, and probably not even worthy of a name, varietal or otherwise. Numbers of specimens have been examined which seem to connect *atlanis* and *intermedius*, and all such are here treated under *atlanis*; only those closely approximating Scudder's figure being referred provisionally to *intermedius*.

Considerable variation in size is noticed, males ranging from 18 to 24 millimeters in the length of body. One male has the caudal tibiae pale reddish, all the others varying shades of glaucous.

One of the typical sage-brush species. In some localities it was quite plentiful.

***Melanoplus atlanis* (Riley).**

Livingston, Park Co., Montana, Aug. 4, 3 ♂, 4 ♀. Electric, Park Co., Montana, Aug. 4, 1 ♂. Jefferson Valley, Montana, Aug. 5, 1 ♀. Three Forks, Gallatin Co., Montana, Aug. 12, 1 ♂. Mammoth Hot Springs, Yellowstone Park, up to 7,050 feet, Aug. 5, 2 ♂, 2 ♀. Fountain, Lower Geyser Basin, Yellowstone Park, Aug. 6, 1 ♀. Pine woods, Old Faithful, Upper Geyser Basin, Yellowstone Park, Aug. 7, 4 ♂, 1 ♀. Salt Lake City, Utah, Aug. 13, 14 ♂, 12 ♀. Hillside, 4,700 feet, Salt Lake City, Utah, Aug. 14, 5 ♂ 1 ♀. Top of Ensign Peak, 4,900 feet, Salt Lake City, Aug. 13, 3 ♂. Five miles south of Salt Lake City, in alfalfa field, Aug. 13, 2 ♂, 3 ♀. Grand Junction, Mesa Co., Colorado, Aug. 15, 1 ♂, 2 ♀. Newcastle, Garfield Co., Colorado, Aug. 16, 1 ♂. Knob Hill, Colorado Springs, Colorado, Aug. 17 to 22, 7 ♂, 2 ♀. Prairie land, Colorado Springs, Aug. 18, 3 ♂, 2 ♀. Manitou, Colorado, Aug. 23, 9 ♂, 1 ♀; same locality at 6,700 feet, Aug. 16, 4 ♂, 1 ♀. Garden of the Gods, Colorado, Aug. 17, 5 ♂, 7 ♀. Dark Cañon, Pike's Peak, 8,920 feet, Aug. 16, 2 ♀. Roggen, Colorado, Aug. 24, 2 ♀.

This series exhibits a very great amount of variation in size and coloration, and in the form of the cerci many of the males placed here approach *intermedius*, as mentioned in the remarks under that form. The dullest specimens with little contrasted coloration are from the Garden of the Gods, and the palest ones are from the vicinity of Salt Lake City. However, while the majority of specimens of each series from the two above localities are uniformly dark or light, a few specimens from each locality are of what might be called the average type. Quite a number of specimens have the caudal tibiae of various shades of glaucous.

A common species in both sage-brush and prairie-grass.

**Melanoplus bilituratus** (Walker).

Salt Lake City, Utah, Aug. 13, 1 ♂. Top of Ensign Peak, Salt Lake City, Aug. 13, 1 ♂.

These specimens are perfectly typical of *bilituratus*, which is probably only a race of *atlanis*. This is the first record of this species from Utah, and the first one east of Fort Halleck, Elko Co., Nevada, except one from Weeksville, Missoula Co., Montana.

These two specimens were both taken on hilly ground covered with sage.

**Melanoplus spretis** (Thomas).

Garden of the Gods, Colorado, Aug. 17, 2 ♀. Mountain View, Pike's Peak, Colorado, Aug. 20, 9,705 feet, 1 ♂.

The capture of these specimens is of considerable interest as it shows that this very destructive species is still present, either as a migrant or as a native, in regions formerly devastated by it. The absence of recent records of this species from Colorado shows it has become a scarce species. The material examined has been compared with individuals from Nebraska and North Dakota.

Two specimens from the Garden of the Gods were taken in a grassy meadow, while the other specimen was taken in an aspen thicket in sparse grass.

**Melanoplus defectus** Scudder.

Muir, Bozeman Tunnel, Park-Gallatin Co., Montana, Aug. 12, 2 ♂. Mammoth Hot Springs, Yellowstone Park, Aug. 5, 1 ♂. Summit of first foothill of Gallatin range, Mammoth Hot Springs, Aug. 5, 2 ♂, 3 ♀. Top of bare hill opposite Devil's Kitchen, Mammoth Hot Springs, Aug. 5, 1 ♂.

This species, previously known only from the type locality, Grand Junction, Colorado, and Nebraska, is quite distinct from the *atlanis-spretis* type, the form of the subgenital plate, which is considerably elongate, being at a glance sufficient to separate it.

**Melanoplus dawsoni** (Scudder).

Muir, Bozeman Tunnel, Gallatin-Park Co., Montana, Aug. 12, 2 ♂, 8 ♀. Knob Hill, Colorado Springs, Colorado, Aug. 22, 2 ♀. Manitou, Colorado, Aug. 23, 1 ♂, 7 ♀. Hillside near Manitou, Colorado, 6,700 feet, Aug. 16, 5 ♂, 7 ♀.

Material from Fort Collins, Colorado, has been examined in this connection. All the material studied belongs to the short-winged type of the species. Taken as a whole the series examined is quite uniform in size, and with such color variation as does exist being chiefly in the lighter or dark shade of the general color.

I found this species quite plentiful in a grassy field choked with many bushes. In this locality the species far outnumbered any other Orthopteron. At Manitou I found it on the hillside, where mountainous plants and scrub oaks formed practically the only vegetation.

***Melanoplus montanus* (Thomas).**

Mammoth Hot Springs, Yellowstone Park, Aug. 5, 3 ♂, 6 ♀.  
Norris Pass, Continental Divide, Yellowstone Park, Aug. 7, 2 ♀.

This rather conspicuous species has previously been recorded only from Montana. The males in the series examined are quite uniform in size and fairly so in coloration. The females vary considerably in size, one from Mammoth Hot Springs being distinctly smaller than the others, which latter are slightly larger than the two females from Norris Pass. The dark colors are more blackish and the browns more rufescent in the Norris Pass individuals than in any others.

A distinctly mountainous species which I found only on the higher hillsides. The insects were powerful but too awkward to escape capture.

***Melanoplus altitudinum* (Seudder).**

Pike's Peak, Colorado, Dark Cañon, 8,920 feet, Aug. 16, 16 ♂, 9 ♀, 1 nymph; upper slope of Dark Cañon, 9,000 feet, Aug. 16, 2 ♂, 2 ♀; below Windy Point, 12,000 feet, Aug. 20, 3 ♂, 2 ♀.

The Dark Cañon specimens are quite uniform in size, but the three Windy Point specimens are smaller than any of the former and the males are smaller than any specimens of the species seen. The smallest Dark Cañon male measures 16.2 millimeters in length, while a Windy Point specimen measures 14.5. There is considerable variation in the intensity of color in the series examined, but the pattern does not vary to any considerable degree. The proximal portions of the antennæ are more red than orange in all the Pike's Peak specimens. The ventral sulcus of the caudal femora is dull yellowish in some specimens and suffused with sanguineous in others.

This species was extremely common in grassy Dark Cañon, while several specimens were also taken in the short grass above the tree-line. The insects were active but easily captured.

***Melanoplus fasciatus* (Walker).**

Pine woods, Old Faithful Geyser, Upper Geyser Basin, Yellowstone Park, Aug. 7, 3 ♂, 6 ♀. Knob Hill, Colorado Springs, Colorado, Aug. 17, 1 ♀. Manitou, Colorado, 6,900 feet, Aug. 23, 3 ♂, 2 ♀. Pike's Peak, Colorado: Mountain View, 9,700 feet, Aug. 20, 1 ♂; Dark Cañon, 8,920 feet, Aug. 16, 1 ♂; below Windy Point, 12,000 feet, Aug. 20, 1 ♀.

These specimens vary considerably in size, as is usual in this species, particularly in the females. No difference is noted between Pennsylvania and New Jersey specimens and those recorded above. All the individuals here studied have the tegmina falling short of the tips of the caudal femora.

The Windy Point record carries the vertical range of this species a thousand feet higher than previous records.

This was the only species to be found in the dense pine woods back of Old Faithful Geyser, and it was one of the very few distinctly sylvan species taken. One specimen, however, was captured above the timber-line on Pike's Peak and one on the prairie outside of Colorado Springs. The insects were extremely powerful and vigorous.

***Melanoplus femur-rubrum* (DeGeer).**

Three Forks, Gallatin Co., Montana, Aug. 12, 2 ♂. Willow Creek, Gallatin Co., Montana, Aug. 12, 2 ♂. Sappington, Gallatin Co., Montana, Aug. 12, 3 ♂, 2 ♀. Mammoth Hot Springs, Yellowstone Park, Aug. 5, 4 ♂, 1 ♀. Geyser crust, Old Faithful, Upper Geyser Basin, Yellowstone Park, Aug. 7, 4 ♂, 1 ♀. Five miles south Salt Lake City, Utah, in alfalfa field, Aug. 13, 1 ♂. Grand Junction, Mesa Co., Colorado, Aug. 15, 1 ♂. Knob Hill, Colorado Springs, Colorado, Aug. 17-22, 39 ♂, 21 ♀. Manitou, Colorado, Aug. 22, 1 ♂, 5 ♀. Garden of the Gods, Colorado, Aug. 17, 1 ♂, 2 ♀. Dark Cañon, Pike's Peak, Colorado, 8,920 feet, Aug. 16, 1 ♂. Roggen, Weld Co., Colorado, Aug. 24, 4 ♂. Table Rock, Pawnee Co., Nebraska, Aug. 25, 1 ♂. Hannibal and Louisiana, Missouri, Aug. 25, 2 ♂. St. Louis, Missouri, Aug. 27, 4 ♂, 1 ♀.

The Colorado series contains individuals which are typical of *M. plumbeus* as understood by Scudder, but from this extremely bright type any number of intermediates, forming a complete chain and connecting the dull form of *femur-rubrum* found in the East, can be selected. From the Knob Hill series alone the extreme *plumbeus* type and typical *femur-rubrum* with seven graded intermediates can be selected. The majority of specimens belong to the intermediate forms, the extremes being scarcer, in the studied series, than the annectant forms.

The authors fully agree with Gillette's remarks<sup>26</sup> on this species and cannot consider *plumbeus* as other than brightly colored *femur-rubrum*. The specimens from Roggen, Colorado, Nebraska and Missouri do not approach *plumbeus*. The specimens from Montana localities are very

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<sup>26</sup> Bull. 94, Colo. Agr. Exp. Sta., pp. 48-50.

noticeably smaller than the others examined. No short-winged individuals have been seen.

This species was found in many localities, but nowhere more common than in the prairie grass outside of Colorado Springs. The brilliantly colored specimens (*M. plumbeus* Dodge) were always found in the damper locations where vegetation was most abundant.

***Melanoplus monticola* Scudder.**

Geyser crust, Old Faithful Geyser, Upper Geyser Basin, Yellowstone Park, Aug. 7, 1 ♀. Near Grand Cañon, Yellowstone Park, Aug. 10, 2 ♂, 3 ♀. Yellowstone Lake, Aug. 7, 7 ♂, 9 ♀. Knob Hill, Colorado Springs, Colorado, Aug. 22, 27 ♂, 17 ♀. Pike's Peak, Colorado, Aug. 20: Mountain View, 9,700 feet, 1 ♂, 1 ♀; Middle Hudsonian, 10,500 feet, 2 ♂; along timber-line, 11,578 feet, 3 ♂; below Windy Point, 12,000 feet, 13 ♂, 12 ♀.

This large series exhibits a considerable amount of variation in color and size, the greater part of which can be attributed to elevation. The specimens from Pike's Peak are all smaller, those from over 11,000 feet particularly, and the colors are as a rule duller. Specimens from Windy Point are as small as 15 (♂) and 16 (♀) millimeters in the length of the body, while those from Knob Hill are much larger and range between 17.5 and 22 (♂) and 23 and 30 (♀). One male and one female from Yellowstone Lake as well the majority of the Pike's Peak individuals are very dark in color, while some of the females from the latter locality are strongly touched with green. The specimens from the lower elevations are quite richly colored, and this with their larger size would seem to indicate another species, but no characters of the appendages seem to warrant their separation. The Middle Hudsonian individuals are perfectly intermediate between the Pike's Peak representatives and the lowland specimens in size and the brilliancy of the coloration.

The species has previously been recorded only from Sierra Blanca, Colorado, 12,000 to 13,000 feet, and from Windy Point, Pike's Peak.

This species was found in exceedingly varied locations. Not only was it abundant in the alpine herbage above the timber-line on Pike's Peak, but it was also plentiful on the prairie outside of Colorado Springs. In the Yellowstone Park the species was found in the decidedly boreal portions.

***Melanoplus canonicus* Scudder.**

Salt Lake City, Utah, Aug. 13, 9 ♂, 4 ♀. Hillside at Salt Lake City, Aug. 14, 2 ♀. Top of Ensign Peak, Salt Lake City, Aug. 13, 2 ♀. Grand Junction, Colorado, Aug. 15, 4 ♀.

These specimens agree fully with the description and figures of this species, which has been previously recorded only from northern and western Arizona. There is considerable variation in size, 20 to 24 millimeters in the length of body of the ♂ and 24 to 28.5 in the ♀. The color of the caudal tibiae varies from pale glaucous to very decided blue, pale laterad, while the general color is more besprinkled with fine spots of umber on the dorsum in some specimens than in others.

This species was found almost invariably among the sage. The color of the insects blends so exactly with the sage-brush that when at rest they are difficult to find. I noticed that the insects almost always sought refuge in the sage instead of on the ground. On and about Ensign Peak the species was plentiful.

***Melanoplus coccineipes* Scudder.**

Knob Hill, Colorado Springs, Colorado, Aug. 17-22, 114 ♂, 77 ♀. Prairie land, Colorado Springs, Aug. 18, 3 ♂, 5 ♀. Manitou, Colorado, Aug. 22, 2 ♀. Garden of the Gods, Colorado, Aug. 17, 5 ♂, 2 ♀. Roggen, Colorado, Aug. 24, 7 ♂, 4 ♀.

This large series presents a considerable amount of variation in size and color. The smallest ♂ measures 17.5 millimeters in the length of body, the largest 22; the smallest ♀ 20, the largest 26. The individuals with the pronotum with a dark median bar superficially much resemble *M. packardii*. The general coloration is quite dark in some individuals and very light in others, the latter type having all the normal darker markings very weak, while some few specimens have the dorsum of the head and pronotum suffused with purplish red. The Roggen individuals are more grayish than any others examined. Of the large series examined all but two have red caudal tibiae, the color usually pale coral red. The other two specimens, a pair from Knob Hill, have glaucous tibiae. The authors are much inclined toward the opinion recently expressed by Gillette,<sup>27</sup> to the effect that *M. coccineipes* represents merely a red-legged form of *M. angustipennis*.

This was one of the species which made up the vast swarms of Orthoptera everywhere to be found in the prairie grasses outside of Colorado Springs. So great was the number of grasshoppers that it was almost impossible to follow any one interesting specimen when seen. All of the specimens of this species were taken by sweeping the grass.

***Melanoplus packardii* Scudder.**

Emigrant, Park Co., Montana, Aug. 4, 1 ♂, 1 ♀. Mammoth Hot

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<sup>27</sup> Bull. 94, Colo. Agr. Exp. Sta., pp. 43, 46.



Springs, Yellowstone Park, Aug. 5, 1 ♀. Salt Lake City, Utah, Aug. 13, 2 ♂, 2 ♀. Top of Ensign Peak, Salt Lake City, Aug. 13, 1 ♂. Five miles south of Salt Lake City, in alfalfa field, Aug. 13, 1 ♂, 4 ♀. Knob Hill, Colorado Springs, Colorado, Aug. 17-22, 18 ♂, 25 ♀. Prairie land, Colorado Springs, Aug. 18, 3 ♀. Garden of the Gods, Colorado, Aug. 17 and 23, 1 ♂, 1 ♀. Fort Morgan, Colorado, Aug. 24, 1 ♀.

From the above series it is quite evident that representatives of this species from the general vicinity of Colorado Springs are smaller than specimens from Montana, Yellowstone Park, Utah and eastern Colorado. Males from Montana, Utah and the Yellowstone range between 27 and 30 millimeters in length of body, while Knob Hill males measure from 22.5 to 26. The single female from Fort Morgan, however, is as large as the average Utah female. Specimens examined from several Nebraska localities are about the same size as the Knob Hill individuals and smaller than the Fort Morgan representative.

In coloration the Montana, Utah and Yellowstone individuals are much more strikingly colored than those from Knob Hill, the colors being more contrasted and richer. In a series of six specimens from Boulder and Fort Collins, examined in this connection, several are brightly colored; one male, the only Boulder specimen, being as striking as Utah individuals.

In the series listed above seven specimens have wholly glaucous caudal tibiae, while the remainder vary from carmine to pale pinkish, including some solferino and very pale purplish tibiae, while one (Salt Lake City) has partially glaucous, partially solferino and purple tibiae, the glaucous pale and limited to the proximal portion of the lateral faces.

The specimens of this species taken at Salt Lake City were almost all from the luxuriant weeds growing along ditches and drains. Those from Colorado Springs were captured in the more heavily weed overgrown spots about damp depressions in the prairie. The insects were active, but often clung tenaciously to the weeds in which they hid, and it was consequently easy to capture as many as desired.

***Melanoplus conspersus* Scudder.**

Colorado Springs, Colorado, Aug. 18, 2 ♂, 1 ♀. Knob Hill, Colorado Springs, Aug. 17-22, 39 ♂, 18 ♀. Prairie land, Colorado Springs, Aug. 18, 2 ♀. Garden of the Gods, Colorado, Aug. 17-19, 13 ♂, 5 ♀. Akron, Washington Co., Colorado, Aug. 24, 1 ♀.

This species in the highly colored individuals is quite handsome and appears rather different from the duller specimens, which differ how-

ever, only in the replacing of the yellow lighter colors with shades of light brown. In some individuals the caudal tibiae are much more valgate than in others, while the inflation of the ventro-lateral carina and the adjacent parts of the caudal femora is quite marked in the male. A rather striking character of the coloration of this species is the continuation of the internal black vertical genicular bar of the caudal femora on the ventral surface, but not on the external face. A blackish patellar spot is present on the caudal tibiae of some specimens and not of others.

The specimens here studied have been compared with paratype material.

This species was one of those which swarmed in the prairie grass. In certain localities where the ground was somewhat damp it occurred in countless numbers.

***Melanoplus alpinus* Scudder.**

Mammoth Hot Springs, Yellowstone Park, 6,500 feet, Aug. 5, 1 ♂.

This specimen has been compared with material from the Big Horn Mountains, Wyoming, and found to agree in all important characters.

The specimen was taken on the summit of the first hill back of the Mammoth Hot Springs Hotel. The ground in that locality was bare, being but sparsely overgrown with short grasses. At the time, the specimen was not noticed to be a desirable insect, and a search for others was consequently not made.

***Melanoplus infantilis* Scudder.**

Livingston, Park Co., Montana, Aug. 4, 1 ♀. Electric, Park Co., Colorado, Aug. 4, 1 ♀. Mammoth Hot Springs, Yellowstone Park, Aug. 5; at 6,215 feet, 3 ♂, 1 ♀; at 6,500 feet, 2 ♂, 1 ♀. Knob Hill Colorado Springs, Colorado, Aug. 22, 1 ♀. Cripple Creek, Teller Co., Colorado, Aug. 19, 1 ♂.

The Cripple Creek specimen of this diminutive species is smaller than the Yellowstone males, while the Livingston specimen is more grayish than any of the others.

This species was found chiefly in the more hilly regions where vegetation was not luxuriant and it was nowhere abundant.

***Melanoplus minor* Scudder.**

Knob Hill, Colorado Springs, Colorado, Aug. 17, 1 ♂. Manitou, Colorado, Aug. 23; at 6,300 feet, 1 ♂, at 6,700 feet, 8 ♂, 6 ♀. One female from Manitou has the caudal tibiae dull purplish red, all other specimens having these parts various shades of glaucous.

With one exception all the specimens of this species were taken on

the steep hillside near the cog-wheel railway station. Orthoptera were not very abundant, but sufficiently plentiful to make collecting among the mountain-loving plants interesting.

***Melanoplus differentialis* (Thomas).**

Knob Hill, Colorado Springs, Colorado, Aug. 18, 1 ♀. Roggen, Weld Co., Colorado, Aug. 24, 1 ♂. Fort Morgan, Morgan Co., Colorado, Aug. 24, 1 ♀. St. Louis, Missouri, Aug. 27, 2 ♂.

Very few specimens of this species were seen in Colorado. At St. Louis, however, the weeds in every vacant field were filled with them.

***Melanoplus bivittatus* (Say).**

Gray Cliff, Sweet Grass Co., Montana, Aug. 4, 1 ♂. Livingston, Park Co., Montana, Aug. 4, 1 ♂. Muir, Bozeman Tunnel, Gallatin-Park Co., Montana, Aug. 12, 1 ♂. Sappington, Gallatin Co., Montana, Aug. 12, 1 ♂. Mammoth Hot Springs, Yellowstone Park, Aug. 5, 1 ♂, 1 ♀. Summit foothill of Gallatin range, 7,000 feet, Mammoth Hot Springs, Aug. 5, 1 ♀. Alfalfa field, five miles south of Salt Lake City, Utah, Aug. 13, 4 ♂, 3 ♀. Knob Hill, Colorado Springs, Colorado, Aug. 18, 1 ♂. Garden of the Gods, Colorado, Aug. 19 and 23, 1 ♂, 1 ♀. Fort Morgan, Morgan Co., Colorado, Aug. 24, 4 ♂, 2 ♀. Roggen, Weld Co., Colorado, Aug. 24, 1 ♀.

This species was more widely distributed than any other taken. Although nowhere found in swarms, it was almost invariably plentiful about the grasses and weeds growing in somewhat damp locations.

**DACTYLOTUM Charpentier.**

***Dactylotum pictum* (Thomas).**

Garden of the Gods, Colorado, Aug. 17, 1 ♂, 5 ♀, 4 nymphs. Aug. 19, 4 ♂, 1 ♀, 3 nymphs.

This species was found in a slightly moist grassy meadow. Considerable time was occupied in searching for specimens and all adults and nymphs met with were taken.

**TETTIGONIDÆ.**

**SCUDDERIA Stål.**

***Scudderella furcata* Brunner.**

Manitou, Colorado, 6,900 feet, Aug. 23, 2 ♂, 3 ♀.

Taken in the oak thickets on the hillside. The species was quite plentiful, but took to flight very readily.

**ORCHELIMUM Serville.**

***Orchelimum vulgare* Harris.**

St. Louis, Missouri, Aug. 27, 8 ♂.

Taken in a vacant lot overgrown with weeds. The species was abundant everywhere in this locality.

***Orechelimum longipenne* Scudder.**

Hannibal, Missouri, Aug. 25, 1 ♂.

This specimen agrees very well with Redtenbacher's description and measurements of his *inermis*, which he proposed to replace *longipenne*. Scudder's original description is brief and unsatisfactory.

The brownish marking on the dorsum of the pronotum is rather pale and nearly uniform in color, the lateral bars being extremely weak.

This single specimen was taken from high weeds growing on the banks of the Mississippi river.

**XIPHIDIUM Serville.**

***Xiphidion fasciatum* (DeGeer).**

Akron, Washington Co., Colorado, Aug. 21, 1 ♀. Roggen, Weld Co., Colorado, Aug. 24, 1 ♀.

***Xiphidion saltans* Scudder.**

Knob Hill, Colorado Springs, Colorado, Aug. 17-22, 4 ♂, 3 ♀. Garden of the Gods, Colorado, Aug. 19, 1 ♀. Roggen, Weld Co., Colorado, Aug. 24, 1 ♂.

The specimen from Roggen is very much paler than the others, the normal green on the sides of the head, pronotum and pleura being replaced with bluish white.

These insects were all taken among the grasses growing in moist locations.

***Xiphidion strictum* Scudder.**

St. Louis, Missouri, Aug. 27, 2 ♂, 2 ♀.

These specimens have been compared with specimens of this species from Nebraska determined by Bruner.

The specimens were taken from a weedy field.

**ANABRUS Haldeman.**

***Anabrus simplex* Haldeman.**

Mammoth Hot Springs, Yellowstone Park, Aug. 5, 5 ♂, 4 ♀. Knob Hill, Colorado Springs, Colorado, Aug. 22, 2 ♀.

These specimens have been examined by Mr. Caudell and are considered true *simplex* by him.

This species was extremely common in the sage-brush about the Mammoth Hot Springs. The males sit on the highest twigs and keep up a continuous droning z-r-r-r-r—somewhat resembling the sounds

produced by *Orchelimum vulgare*. When alarmed the insects fairly tumble from their perch and hurriedly seek their holes at the plant's roots. So quickly can these apparently clumsy insects reach their holes that it is only possible to surprise them still in the bush by approaching with the greatest caution. The insects are exceedingly poor at jumping and are completely helpless when removed from their home bush.

**Anabrus coloradus** Thomas.

Manitou, Colorado, Aug. 23, 4 ♂, 2 ♀. Hillside at 6,700 feet, Manitou, Aug. 16, 1 ♀. Halfway House, Pike's Peak, Aug., 2 ♂. Mountain View, Pike's Peak, 9,700 feet, Aug. 20, 1 ♂.

These specimens have also been examined and determined by Mr. Caudell.

These insects were all taken from low bushes growing in or near the woods on the slopes of Pike's Peak. Their stridulations were quite long.

**STEIROXYS** Herman.

**Steiroxys trilineata** (Thomas).

Muir, Bozeman Tunnel, Gallatin-Park Co., Montana, Aug. 12, 1 ♀. Mammoth Hot Springs, Yellowstone Park, Aug. 5, 3 ♀. Summit of foothill of Gallatin range, Mammoth Hot Springs, Yellowstone Park, 7,000 feet, Aug. 5, 2 ♀. Near Grand Cañon, Yellowstone Park, Aug. 10, 2 ♀. Yellowstone Lake, Yellowstone Park, Aug. 7, 2 ♀.

Most of these specimens would by the rather uniform dorsal face of their abdomen be referred to *pallidipalpus*, but the authors do not consider the blackish V-shaped maculations of the abdomen constant enough to use for the separation of the two "forms."

This species was somewhat plentiful under sage-brush. They inhabited holes at the roots of these bushes, in which they sought refuge upon the least sign of danger. They hopped along awkwardly, but disappeared in their holes with surprising speed.

**EREMOPEDES** Scudder.

**Eremopedes balli** Caudell.

Austin Bluffs, Colorado Springs, Colorado, Aug. 18, 1 ♂. Prairie land, Colorado Springs, Aug. 18, 2 ♀.

This species was previously known only from Fort Collins, Colorado, and Williams and Flagstaff, Arizona. This species was found on the ground among grasses. It is strictly terrestrial.

**GRYLLIDÆ.****NEMOBIUS** Serville.**Nemobius fasciatus** (DeGeer).

Mammoth Hot Springs, Yellowstone Park, Aug. 5, 2 ♂, 2 ♀. Geyser crust, Old Faithful, Upper Geyser Basin, Yellowstone Park, Aug. 7, 1 ♂, 1 ♀. Five miles south of Salt Lake City, Utah, in alfalfa field, Aug. 13, 1 ♂. St. Louis, Missouri, Aug. 27, 1 ♀.

All specimens in this series are brachypterous.

**GRYLLUS** Linnaeus.**Gryllus pennsylvanicus** Burmeister.

On geyser formation at the upper end of Mammoth Hot Springs, Yellowstone Park, Aug. 5, 2 ♀. Brush, Morgan Co., Colorado, Aug. 24, 1 ♀. St. Louis, Missouri, Aug. 27, 1 ♀.

The specimens are brachypterous.

The specimens taken at the Hot Springs were lying dead on the geyser formation, evidently killed by the fumes issuing from a nearby vent hole.

**CECANTHUS** Serville.**Cecanthus quadripunctatus** Beutenmüller.

Knob Hill, Colorado Springs, Aug. 18-22, 5 ♂. Prairie land, Colorado Springs, Aug. 18, 1 ♂. Garden of the Gods, Colorado, Aug. 17, 1 ♂.

The antennal maculations, particularly on the proximal joint, vary considerably in shape, in one specimen approaching *fasciatus* and in others approaching *pini*.

A common species on the higher weeds and bushes growing on the prairie. Their low but continuous stridulating would be heard often many yards away.

## ON SOME REPTILIAN FREAKS FROM INDIANA.

BY W. S. BLATCHLEY.

Cases of deformity or malformation are seemingly much less common among wild forms of life than among mankind or his domestic animals. One often sees or hears of two-headed calves, five-legged pigs and four-legged chickens, but "freaks" among wild mammals, birds and reptiles come to notice but seldom. In the literature on herpetology at my command I can find only the following records of malformation among reptiles and batrachians in the United States.

Dr. Samuel L. Mitchill, in the early part of the nineteenth century, published an article entitled "Facts and considerations showing that the Two-Headed Snakes of North America and other parts of the World are not individuals of a distinct race, but universally Monsters,"<sup>1</sup> in which he recorded the finding in Genesee county, New York, of 120 of the young of a female black snake, *Bascanion constrictor* L., among which were "three monsters, one with two distinct heads; one with a double head and only three eyes; and one with a double skull, furnished with three eyes and a single lower jaw; this last had two bodies." These three specimens he figured on an accompanying plate.

Dr. Mitchill noted that records of two-headed snakes had been made up to that date from the "West Indian and Polynesian islands; in Great Britain and in Italy," and that those from the foreign countries had been supposed to "constitute a race of their own and propagate their kind in regular succession." His paper, based on the finding in New York of three individuals among one litter, was written to controvert this foolish supposition. He added that "serpents are destitute of limbs, and are consequently incapable of monstrosity in feet, legs, hands and arms, either by defect, redundancy or malformation; when it happens, therefore, monstrosity must be in the head or tail, and the head is most frequently the seat of it."

Prof. Jeffries Wyman recorded the occurrence in Massachusetts of a specimen of water snake, *Tropidonotus sipedon* (L.), with two heads and two tails.<sup>2</sup>

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<sup>1</sup> *American Journ. Science and Arts*, X, 1826, 48.

<sup>2</sup> *Proc. Bost. Soc. Nat. Hist.*, IX, 183.

In the *American Naturalist*, Vol. XII, 1878, p. 470, Mr. H. C. Yarrow stated that there was "but one two-headed snake in the enormously large collection of reptiles in the Smithsonian Institution." This was a specimen of *Ophibolus getulus* (L.), the common chain or king snake, from Port Tobacco, Maryland.

In the same volume, page 694, Dr. J. S. Kingsley mentioned a two-headed snake, species not given, as being in the collection of Williams College, Massachusetts.

In his "Report on the Reptiles and Batrachians of Ohio,"<sup>3</sup> Dr. W. H. Smith stated that the Museum of Michigan University contains a double-headed milk snake, *Ophibolus doliatus triangulus* (Boie). He added: "Cases of monstrosities among serpents have been observed by various parties from the time of Aristotle and Redi to the present, and they, as well as the occurrence of monsters in general, may be due to shock."

Concerning two-headed turtles I can find but one reference, viz., Dr. Mitchill, *loc. cit.*, says: "I have heard of a two-headed tortoise (*Testudo*) that lived to acquire a considerable size, by having taken food at both mouths."

But two notes regarding malformation among batrachians are at hand. One of these is by Dr. Kingsley, *loc. cit.*, in which he records a specimen of a five-legged frog, *Rana palustris*, from Rochester, New York. The other, by Smith, *loc. cit.*, refers to a mention by Ryder<sup>4</sup> of another five-legged frog of the same species.

During the past fifteen years examples of four two-headed snakes, one two-headed turtle, one five-legged frog and one two-tailed salamander from Indiana have come to my notice. While I have seen but two of the individuals, the records of the others can be relied upon.

*Two-headed Snakes.* a. Of the snakes, one at hand as I write is a specimen of the spreading viper, *Heterodon platyrhinus* Latr., six and a half inches in length, taken near Manilla, Rush county, by S. C. Peck in August, 1904, and by him presented to the State Museum. It has two perfect heads, both possessing the scale formula of the species. Each head stands out at nearly right angles to the median line of the front extremity of the body, the center or keel of the two rostral plates being 22 mm. apart. The two heads unite just back of the hindmost of the inner lower labials, there being three rows of small scales between the inner upper labials. Viewed from above, the right head appears

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<sup>3</sup> *Geol. Surv. of Ohio*, IV, 1882, 690.

<sup>4</sup> *Science News*, December 15, 1878, p. 69



very slightly longer than the left, but when compressed together there is no difference, each one being 13 mm. in length. The two oesophagi unite in a common gullet just back of the point of union. In all other respects the specimen is a typical young form of *H. platyrhinus*.

b. A small two-headed garter snake was taken on a farm southwest of Russellville, Putnam county, and was kept in alcohol for several years. It was reported to me by several parties who had seen it, but was thrown out on account of decay, due to loss of alcohol, several weeks before I visited the place. The heads were said to unite about two inches back of the rostral plate, each having a small portion of the body between it and the point of union.

c. In June, 1893, a friend reported to me that his son had killed a two-headed snake in a woods pasture near Terre Haute. In company with the boy I visited the spot the next day, but found that the buzzards had been ahead of me and that only a small portion of the body was left. It was a house or milk snake, *Ophibolus doliiatus triangulus* (Boie), and, judging from the fragments and the account of the boy, had been about two and a half feet in length. He said that the heads forked five or six inches back from the front extremity of the body.

d. In the *Indianapolis News* of July 19, 1893, John Collett, ex-State Geologist of Indiana, mentions a "double-headed garter snake as having been taken west of the Wabash river in Vermillion county a few years previously."

*Two-headed Turtle*.—On May 1, 1892, John Tiley, a coal operator, found, near Waterman, in the southwest corner of Fountain county, Indiana, a two-headed turtle. It was presented to Dr. George T. De Verter, who kept it for more than a year, when by accident it was drowned. It was presented in alcohol to Prof. John Collett, of Indianapolis, and, according to the *Indianapolis News* of July 19, 1893, had "nothing to distinguish it from the ordinary little river turtle that sits with a row of fellows on a log and plunks into the water when you creep up with designs upon its freedom. Its back appears a little broader than usual to give it neck room. The heads are not joined and do not interfere with each other's independence. Each has its little sack to retreat into in time of danger. Each has two fully developed eyes, a complete and efficacious mouth and a full throat which is beautifully striped in black and yellow lines. Each has a little stripe of red retreating from each eye, and the heads are twins in size. Either head would have been good enough to serve a turtle of ordinary ambition."

The *News* published a crude drawing of the turtle, and from it and the

above description, I judge that the animal was very probably a specimen of the lady turtle, *Chrysemys marginata* (Agassiz). Dr. De Verter informed the writer that when kept in an aquarium and fed, each head acted wholly independently of the other, the two being thrust forth for different articles of food—meat, mosquito larvæ, tadpoles, etc.—at the same time or at intervals, as occasion and opportunity demanded. What finally became of the specimen on the death of Prof. Collett is not known.

*Five-legged Frog.*—In the spring of 1892, while teaching zoology at Terre Haute, I heard several times of a five-legged frog at a greenhouse in that city. I finally visited the place, but the specimen could not be located. The proprietor informed me that he had seen it on a number of occasions, and had caught it once and then let it go. According to his description, it was probably a specimen of the leopard frog, *Rana virescens* Kalm, with a fifth leg of the same size as each of the two front ones, which was joined to the left side about an inch back of and a little higher than the normal front leg. The specimen was not seen after my visit and probably fell a victim to some prowling cat.

*Two-tailed Salamander.*—On June 21, 1906, I took from an ancient shell mound which was being excavated near Shoals, Martin county, a small specimen of the ashy salamander, *Plethodon cinereus* (Green), which possesses a forked tail. The animal itself was only 38 mm. in length, the tail comprising 12 mm., or nearly one-third. At a point near the middle the tail forked, the two prongs being separated in life by an angle of about 30 degrees. The left or longer fork was 7 mm. in length, while the right or shorter one was but 5 mm. long. Instead of being cylindrical as in typical specimens, each portion was flattened, with rather sharp edges above and below.

It is very probable that cases of malformation among reptiles and batrachians are much more common than is generally supposed. It is safe to say that not more than ten per cent. of the normal individuals which are born or hatched ever come within the range of man's vision. The great majority of the malformed ones are, like those of the domestic animals, either still-born or short-lived. The number of specimens of "freaks" which come to the notice of man is, therefore, doubtless a very small per cent. of those which actually occur.

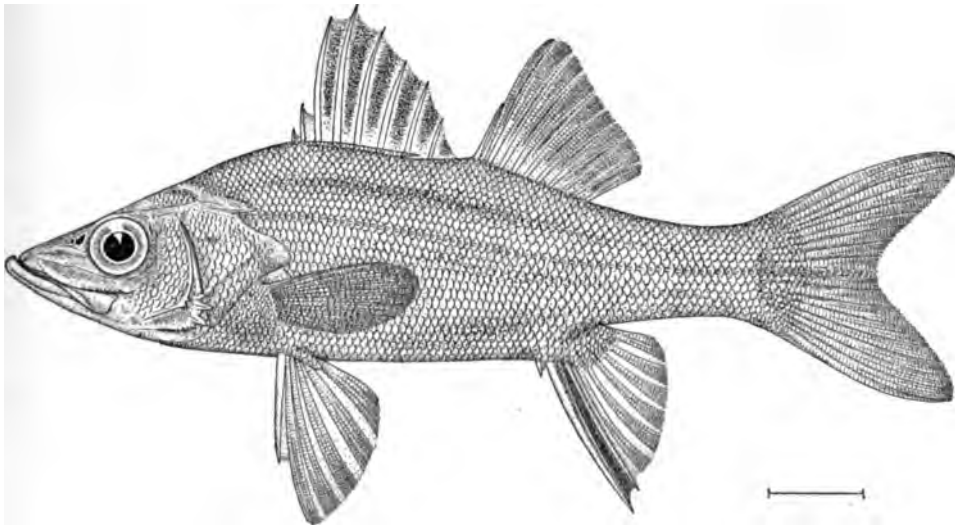
To the factor of natural variation, rather than that of "shock," is probably due the malformations which do occur. If but three specimens out of 120 of one brood of snakes were malformed on account of a shock to the pregnant mother, why did not that shock affect the others?

## DESCRIPTIONS OF TWO NEW SPECIES OF CENTROPOMUS.

BY HENRY W. FOWLER.

*Centropomus gabbi* sp. nov. Fig. 1

Head  $2\frac{3}{4}$ ; depth  $3\frac{1}{4}$ ; D. VIII, I, 10, 1; A. III, 6, 1; P. II, 13; V. I, 5; scales 66 in lateral line to base of caudal, and 17 more out from latter to end of median rays; 12 scales in a vertical series between origin of spinous dorsal and lateral line; 13 scales in a vertical series between origin of rayed dorsal and lateral line; 15 scales in a vertical series between origin of spinous anal and lateral line; 7 scales in a vertical series between lateral line and middle of upper surface of caudal peduncle; width of head 3 in its length; depth of head at occiput  $1\frac{1}{8}$ ; mandible  $1\frac{1}{8}$ ; fourth dorsal spine 2; second dorsal ray  $2\frac{1}{2}$ ; second

Fig. 1.—*Centropomus gabbi* Fowler.

anal spine  $1\frac{1}{2}$ ; first anal ray  $1\frac{1}{8}$ ; least depth of caudal peduncle  $3\frac{1}{4}$ ; upper caudal lobe about  $1\frac{1}{8}$ ; pectoral  $1\frac{5}{8}$ ; ventral  $1\frac{3}{8}$ ; snout  $3\frac{7}{8}$  in head, measured from tip of upper jaw; eye  $4\frac{3}{8}$ ; maxillary  $2\frac{1}{2}$ ; interorbital space  $6\frac{3}{8}$ .

Body compressed, elongated, back a little elevated, or more convex than lower profile, and greatest depth falling at origin of spinous dorsal. Edges of body rounded. Chest flattened. Least depth of caudal peduncle  $1\frac{1}{2}$  in its length.

Head compressed, sides flattened so that its width is equally wide above and below. Profile similarly inclined, and nearly straight. Muzzle prominent, robust. Snout as long as broad and with convex surface. Eye rather large, circular, touching upper profile and falling about first  $\frac{2}{3}$  in length of head. Mouth moderately large, inclined a little, and with gape straight. Mandible broad, depressed on lower surface, rami elevated posteriorly inside mouth, symphysis with slightly elevated dentigerous process and protruding well in front of snout. Lips rather thin and fleshy. Maxillary reaching middle of orbit, its upper edge slipping below preorbital to its extremity, and distal expansion equals diameter of pupil. Bands of villiform teeth in jaws, on vomer and palatines. Tongue smooth, free and rounded in front. Nostrils adjoining, close to front rim of eye, and posterior a little larger. Along lower edge of preorbital 10 backwardly directed denticles. Along ridge of preopercle at angle 2 denticles. Margin of preopercle finely serrated, with about 6 especially enlarged serræ at angle. Edge of suprascapula with graduated denticles to last or posterior, which is largest. Interorbital space flat with 2 equidistant parallel frontal ridges, convergent anteriorly at snout. Parietal ridge, beginning as supraocular, also prominent and becoming somewhat convergent towards occiput. A ridge on preorbital. Opercle ending in a rather broad cutaneous flap posteriorly above.

Gill-opening extending forward opposite front rim of orbit. Gill-rakers II, 5 + 10, IV, lanceolate, slender, longest much longer than filaments, or  $\frac{3}{4}$  of orbit. Gill-filaments about equal pupil. Pseudo-branchiæ smaller than filaments. Isthmus narrow and with slightly convex surface.

Scales finely ctenoid, in even longitudinal series parallel with lateral line, and those on middle of side largest. Scales small on predorsal region, also those on or at bases of fins. About 12 series of scales on cheek. Head naked, except cheek, postocular region, opercle, subopercle, parietal region and occiput, though scales on opercle much largest. A narrow basal scaly sheath extending till behind seventh dorsal spine. Base of rayed dorsal covered with small scales, also of anal and caudal. Axil of pectoral with a pit, a cutaneous membrane covering it above. Ventral with a pointed scaly flap in axil about  $\frac{1}{2}$  length of spine. Lateral line conspicuous, of simple large tubes,

and sloping down in a curve till on middle of side of caudal peduncle, and persisting on caudal to tips of median rays.

Spinous dorsal inserted a little nearer tip of mandible than base of last dorsal ray, graduated down from fourth spine which is longest, and edge of fin not notched. Rayed dorsal inserted nearly an eye-diameter nearer base of caudal than eye, and graduated down from second ray which is longest, though first and third but slightly shorter. Spine of rayed dorsal less than half height of fin. Spinous anal inserted nearer base of caudal than origin of ventral, second spine longest enlarged, and falling about half an eye-diameter short of base of caudal. Third anal spine long, slender, and but a trifle shorter than second. Rayed anal graduated down from first ray which is longest, and about equal to third anal spine. Caudal deeply emarginated, forked, lobes pointed, apparently equal, and median rays about half length of upper lobe. Pectoral broad, upper rays longest, and reaching about  $\frac{4}{5}$  to spinous anal. Ventral inserted just behind base of pectoral, reaching  $\frac{3}{4}$  of space to spinous anal, and spine about  $\frac{3}{4}$  length of fin. Vent a trifle before tips of ventrals.

Color in alcohol dull brassy-brown, with obscure olivaceous tints above, and lower surface scarcely paler. Body also with shining or silvery reflections in some lights. Lateral line brownish, not much darker than body-color. Fins all more or less dilute brownish. Spinous dorsal with greater median portion of each membrane largely dusky-brown, and same of rayed dorsal and caudal, though basal portions of membranes of these fins pale. Membrane between second and third anal spines dusky. Outer front proximal regions of ventrals tinted with brownish dustings. Iris dull brownish.

Length  $10\frac{1}{2}$  inches.

Type, No. 13,469, A. N. S. P. Eastern San Domingo. Prof. William M. Gabb.

Known to me from the single example described above. It is close to the figure of *C. mexicanus* by Vaillant and Bocourt, which species according to Dr. Regan is undoubtedly identical with *C. parallelus*. *C. gabbi* differs from the aforementioned figure in the third dorsal spine being shorter than the fourth, the shorter spine of the rayed anal, the comparatively shorter second anal spine, which is but a trifle longer than the third, and several other characters, such as the presence of more preorbital serræ, etc.

(Named for Prof. William M. Gabb, who collected fishes in San Domingo.)

*Centropomus heringi* sp. nov. Fig. 2.

Head  $2\frac{3}{4}$ ; depth  $3\frac{3}{4}$ ; D. VIII-I, 10, 1; A. III, 6, 1; P. II, 14; V. I, 5;

scales 70 in lateral line to base of caudal, and 16 more on caudal; 10 scales between origin of spinous dorsal and lateral line in a vertical series; 12 scales in a vertical series between origin of rayed dorsal and lateral line; 15 scales in a vertical series from origin of spinous anal to lateral line; width of head  $3\frac{1}{2}$  in its length; depth of head at occiput  $1\frac{1}{2}$ ; mandible 2; sixth dorsal spine  $2\frac{1}{2}$ ; second anal spine  $1\frac{1}{2}$ ; third anal spine  $1\frac{1}{2}$ ; least depth of caudal peduncle  $3\frac{1}{2}$ ; pectoral  $1\frac{1}{2}$ ; ventral  $1\frac{1}{2}$ ; ventral spine  $2\frac{1}{2}$ ; snout  $3\frac{1}{2}$  in head, measured from tip of upper jaw; eye  $4\frac{1}{2}$ ; maxillary  $2\frac{1}{2}$ ; interorbital space  $7\frac{1}{2}$ .

Body moderately elongate, well compressed, and greatest depth about middle of base of spinous dorsal. Back a little elevated or

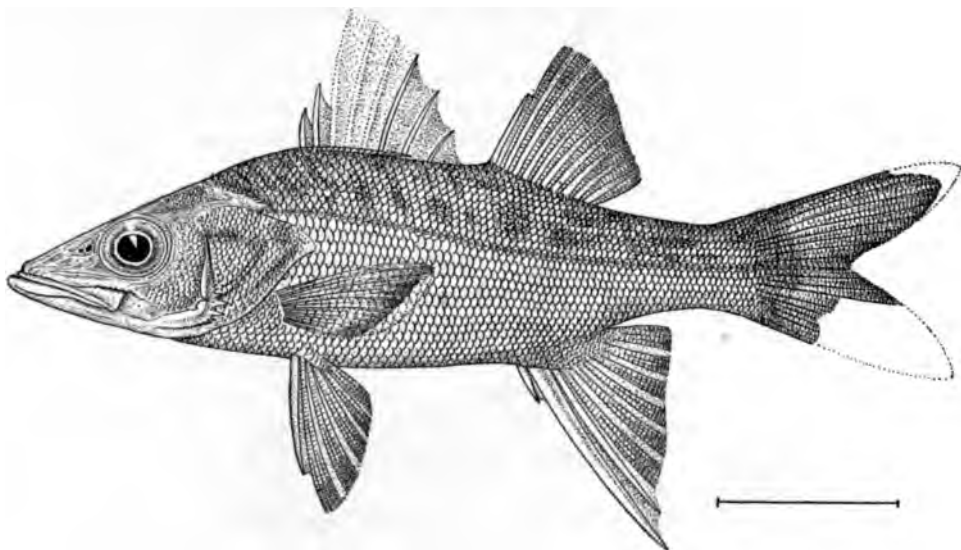


Fig. 2.—*Centropomus heringi* Fowler.

profile above more convex than below. Edges of body rounded. Caudal peduncle compressed, and least depth which falls about last third of its length about  $1\frac{1}{2}$  in latter.

Head compressed, sides flattened and appearance attenuated. Upper profile nearly straight from tip of snout to occiput and much more inclined than lower. Snout convex, rounded when viewed from above with a slight depression in front, and longer than wide. Eye a little ellipsoid, touching upper profile, and its center about first  $\frac{2}{3}$  in length of head. Pupil circular. Mouth nearly horizontal. Mandible spatulate, projecting well beyond tip of upper jaw, and each

ramus but little elevated inside of mouth. Maxillary reaching beyond front of pupil slightly, though not to middle, and distal expansion emarginated posteriorly  $2\frac{1}{2}$  in horizontal orbital diameter. Margin of preorbital with 6 backwardly directed teeth or serræ. Bands of very fine teeth in jaws and on vomer and palatines, those on latter very narrow. Tongue narrow, elongately triangular, and free in front. Lower lip laterally rather fleshy. Nostrils near together, posterior larger and close in front of eye, and anterior placed about last  $\frac{1}{3}$  in length of snout. Interorbital space rather narrow and flattened, frontal and supraocular keels nearly equidistant. Posterior ridge of preopercle well serrated, at angle 2 large denticles and lower edge with coarser serratures than those on vertical margin. Ridge just in front with 2 small serræ at angle. Opercle ending in a long thin flap above. Suprascapula coarsely serrate above.

Gill-opening extending forward opposite front margin of orbit. Gill-rakers II, 5 + 11, III, lanceolate, and longest longer than longest filaments, or about  $1\frac{1}{2}$  in horizontal orbital diameter. Isthmus narrow, and with a slight median furrow.

Scales small, in series parallel with lateral line, small and crowded on predorsal region, where they number about 25, and on bases of vertical or unpaired fins. Scales also small on breast and about chest. About 7 series of scales on cheek. Opercles, and a patch on each side of head above behind eye, scaly. With these exceptions head more or less cavernous and with prominent ridges. Dorsals and anals with basal scaly sheaths. Axil of ventral with a scaly flap covered with a number of small scales. Lateral line of large simple tubes, prominent, and uniform in color with rest of body.

Spinous dorsal inserted a trifle behind origin of ventral, third and fourth spines evidently longest? (though missing) and others graduated down. Rayed dorsal inserted nearly midway between posterior rim of orbit and base of caudal, and rays highest anteriorly. Spinous anal inserted nearly midway between origin of ventral and base of caudal or opposite base of fourth dorsal ray. Second anal spine very long, nearly straight, longer than third, and reaching beyond base of caudal. Anal rays graduated down from first which is longest. Caudal forked, lobes evidently pointed. Pectoral reaching a little beyond base of last dorsal spine, though not quite opposite origin of second dorsal. Ventral inserted a little behind origin of pectoral, and reaching  $\frac{1}{2}$  of space to anal, though a little short of origin of rayed dorsal. Vent a little before tips of ventrals or about  $\frac{1}{4}$  in post-ventral space.

Color in alcohol pale brown, more or less uniform, lower surface and sides with bright reflections. Back with obscure underlaid mottlings. Iris dull yellowish.

Length  $5\frac{1}{2}$  inches.

Type, No. 13,421, A. N. S. P. Surinam or Dutch Guiana. Dr. Charles Hering.

Known to me only from a single poorly preserved example which is closely related to *C. argenteus*. It differs, however, chiefly in having 12 scales in a vertical series between the origin of the rayed dorsal and the lateral line, and in the variegated back. The profile of the head is also less attenuated and the second anal spine reaches further beyond base of caudal.

(Named for Dr. Charles Hering, who collected fishes many years ago at Surinam or Dutch Guiana.)

Other species examined are *C. pectinatus* Poey from Surinam, *C. constantinus* Jordan and Evermann from Rio Janeiro and Los Matheos in Brazil, *C. argenteus* Regan from Surinam, *C. cuvieri* Bocourt from eastern San Domingo, *C. armatus* Gill from western Mexico, *C. pedimacula* Poey from Havana, and *C. ensiferus* Poey from eastern San Domingo.



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PROCEEDINGS  
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1906

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THE ACADEMY OF NATURAL SCIENCES  
OF  
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1907

PUBLICATION COMMITTEE.

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OCTOBER 2.

Mr. ARTHUR ERWIN BROWN, Vice-President, in the Chair.

Thirty-three persons present.

The deaths of Joseph F. Sinnott, June 20, of Howard N. Potts, July 24, members, and of the following correspondents: C. R. Von Osten Sacken, Eugène Renevier, Henry A. Ward, Diomys Stur and E. F. Recluz, were announced.

The Publication Committee reported that papers under the following titles had been offered for publication since the last meeting:

"Description of Five New Species of Orthoptera from Tonkin," by James A. G. Rehn (May 17).

"Description of Two New Polychæta from Alaska," by J. Percy Moore (June 20).

"Note on the Dusky Salamander," by H. W. Fowler (July 7).

"On Some Fishes of Western Cuba," by N. E. McIndoo (July 7).

"On Some Reptilian Freaks from Indiana," by W. S. Blatchley (July 7).

"A Contribution to the Knowledge of the Orthoptera of Montana, Yellowstone Park, Utah and Colorado," by James A. G. Rehn and Morgan Hebard (August 31).

"Description of Two New Species of Centropomus," by Henry W. Fowler (September 10).

*Botanizing in the Canadian Rockies.*—Mr. STEWARDSON BROWN remarked that during the past summer, through the liberality of Mrs. Charles Schäffer, June and July were spent in studying the plants of the Canadian Rockies, along the line of the Canadian Pacific Railway.

The section explored was from Banff, Alberta, to Glacier, B. C., with side trips into the region surrounding Lake Louise, to the south of Laggan Station, and the Ptarmigan, Blind, and part of the Pipestone Valleys to the north; Lake O'Harra, Emerald Lake, the Yoho and Little Yoho Valleys, in the vicinity of Field, B. C.

Collections were made consisting of 808 numbers, comprising about one-third as many species and more than 4,000 specimens.

As these have not yet been critically studied it is impossible to indicate how many may be new to science; it is reasonable to suppose, however, that there are some novelties among them. The species

forming the forest east of the divide appear to differ considerably from those of the west, due doubtless to the greater precipitation of moisture on the latter region. Near the limit of timber and in open ground, where the effect of such conditions would not be so marked, they appear to be nearly identical.

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OCTOBER 16.

Dr. BENJAMIN SHARP in the Chair.

Twenty-five persons present.

*Weather Predictions.*—MR. HARVEY M. WATTS remarked that a new epoch is about to dawn in meteorological research, in that the United States Weather Bureau expects within a month to receive daily reports from the entire northern (circum-Polar) hemisphere—Europe, Siberia, Alaska, and so on around from west to east—allowing the meteorologists for the first time to have synoptic charts made covering this immense area of the inhabited globe.

In explaining the significance of this, Mr. Watts went into a careful survey of the great basic causes of weather and climate variations. He called attention to the universal drift of the general circulation from west to east about the Pole in the regions north of the Tropics, in which general circulation are carried by the travelling cyclones and anti-cyclones (centers of low and high barometric pressures), and he indicated how the paths of these travelling eddies were determined by the pressures and location of the sub-Tropical high pressure belts, which form in the Atlantic and Pacific Oceans huge permanent anti-cyclones, upon whose seasonal shifting and variations in pressure depend the general variations in weather and climate.

The speaker called attention to the fact that the variation in place and pressure of these anti-cyclones (the sub-Tropical high pressure belts), it was now held generally by meteorologists, were due to variations in the radiation from the sun. It is known that the sun is a variable star, whose radiation varies from time to time as much as ten per cent.

These solar variations affect the pressure in the sub-Tropical region, and the variations in the pressures in the sub-Tropical region in turn affect atmospheric pressures the earth over, determining the path of storms and clear weather phenomena, and also general climatic effects, such as excessive rains, droughts, hot and cold summers and their contraries.

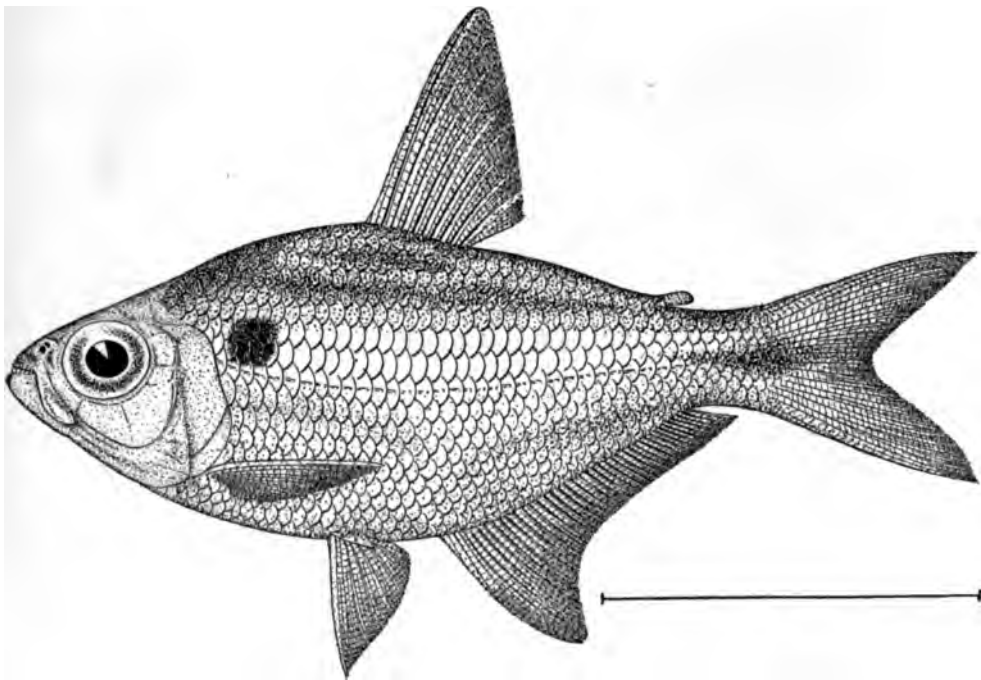
The following were ordered printed:

## FURTHER KNOWLEDGE OF SOME HETEROGNATHOUS FISHES. PART II.

BY HENRY W. FOWLER.

**Astyanax stilbe** (Cope). Fig. 34.

*Tetragonopterus stilbe* Cope, Proc. Amer. Philos. Soc. Phila., XI, 1869-70 (August 19, 1870), p. 559. Type, No. 8,085, A. N. S. P. Para. De Schulte Buckow.—Cope, *l.c.*, p. 566 (evidently type).

Fig. 34.—*Astyanax stilbe* (Cope).

Width of head 2 in its length; interorbital space  $2\frac{1}{2}$  in head measured from tip of upper jaw. Body compressed. Predorsal region with a median keel, and postdorsal region rounded. Preventral region rounded and postventral region trenchant. Caudal peduncle compressed. Head compressed. Snout moderately broad and surface convex. Rami of mandible not elevated inside mouth. Teeth in jaws mostly quindentate, 4 on each side in an outer series above, and

mandibulars large and powerful in front. A small basal maxillary tooth inside. Tongue flattened, rounded and a little free. Interorbital space convex. Gill-opening extending forward not quite opposite end of maxillary. Rakers 9 + 12?, lanceolate, and shorter than filaments which are  $\frac{4}{5}$  of eye. Each scale with a few striæ. Tubes of lateral line simple. Vent close in front of anal. Color in alcohol pale brown, back a little darker than sides and lower surface with more or less silvery reflections. A silvered streak from humeral region, including rather vertical dusky-brown humeral blotch, to caudal, where it becomes dark brownish and continues out on median rays. Fins all dull or pale uniform brownish. Iris brassy-brown. Length  $2\frac{1}{2}$  inches.

**Astyanax moorii** (Boulenger).

*Tetragonopterus moorei* Cope, Proc. Amer. Philos. Soc. Phila., XXXIII, 1894 (January 5), p. 107. Near Chapada, in Matto Grosso, from the headwaters of the Paraguay. H. H. Smith.

Head  $3\frac{3}{4}$ ; depth 3; D. III, 9; A. IV, 28, 1; scales 37 in lateral line to base of caudal, and 3 more on latter; 9 scales obliquely from origin of dorsal to lateral line; 7 scales from origin of anal to lateral line; pectoral  $1\frac{1}{2}$  in head; ventral  $1\frac{1}{2}$ ; snout  $3\frac{1}{2}$  in head measured from tip of upper jaw; eye  $3\frac{1}{2}$ ; maxillary 2; interorbital space 3. Body elongate ovoid. An obtuse median predorsal keel, also one on postdorsal and postventral regions, preventral region rounded. Head rather short, deep, compressed, muzzle blunt. Mouth a little inclined. Maxillary reaches middle of eye and its expansion  $\frac{2}{3}$  of same. Maxillary with several basal teeth. Tongue fleshy, little free. Interorbital space convex. Opercle deep, and second infraorbital with rather indistinct striæ. Gill-rakers 10 + 12, shorter than filaments, which are  $\frac{4}{5}$  of eye. Each scale with a few striæ. Tubes of lateral line simple. Color in alcohol brown, more or less with dull silvered reflections. Lower surface paler or duller brownish than back. A blackish humeral blotch larger than orbit. Side with a broad grayish diffuse streak from gill-opening above towards base of caudal. In latter region this grayish shades into dusky or blackish and extends out on median caudal rays. Fins otherwise all pale brownish, dorsal and caudal a little darker. Jaws a little brownish in front. Iris light brown with a dark brown ring. Length  $4\frac{1}{2}$  inches.

**Astyanax bimaculatus** (Linnaeus).

*Tetragonopterus caudimaculatus* Cope, Proc. Amer. Philos. Soc. Phila., XXXIII, 1894 (January 5), p. 107. Headwaters of the Tocantins. H. H. Smith.

Head  $3\frac{1}{2}$ ; depth  $2\frac{3}{4}$ ; D. III, 9; A. IV, 31, 1; scales 40 in lateral line to



base of caudal, and 3 more on latter; 9 scales in an oblique series back from origin of dorsal to lateral line; 7 scales from base of ventral to lateral line; 16 scales before dorsal; pectoral  $1\frac{3}{4}$  in head; ventral  $1\frac{1}{2}$ ; least depth of caudal peduncle  $2\frac{1}{4}$ ; snout  $3\frac{3}{8}$  in head, measured from tip of upper jaw; eye  $3\frac{1}{2}$ ; interorbital space  $2\frac{1}{4}$ . No maxillary teeth. Gill-rakers 10 + 14 on first arch, slender, pointed and much shorter than filaments. Origin of dorsal nearer tip of upper jaw than base of caudal. Color in alcohol brownish, back darker than side and lower surface. Black humeral blotch conspicuous. Blackish dash at base of caudal and on side of caudal peduncle also pronounced. Each scale on side with a few brownish points or dots so that indistinct longitudinal series are formed. Iris brownish with a darker ring. Length  $4\frac{1}{2}$  inches. Headwaters of the Tocantius. H. H. Smith. Also 3 other examples with same data showing: Head  $3\frac{3}{8}$  to  $3\frac{1}{2}$ ; depth  $2\frac{1}{2}$  to  $2\frac{3}{4}$ ; D. III, 9; A. IV, 28, 1 to IV, 29, 1, usually latter; scales 38 to 42 in lateral line to base of caudal, and 3 more on latter; 9 scales in an oblique series from origin of dorsal back to lateral line; 7 or 8 scales from base of ventral to lateral line; 9 scales from origin of anal to lateral line; 15 or 16 scales before dorsal; total length of specimens 3 to  $4\frac{3}{8}$  inches.

Cope was evidently wrong in identifying this near *Tetragonopterus caudomaculatus* Günther which has only 26 anal radii.

Also two in bad condition from the Peruvian Amazon. Prof. J. Orton. One of these has the humeral blotch large and pronounced.

***Astyanax laeustris* (Lütken).**

Head  $3\frac{3}{8}$ ; depth  $2\frac{1}{4}$ ; D. III, 9; A. IV, 27, 1; scales 35 in lateral line to base of caudal, and 2 more on latter; 8 scales obliquely back from origin of dorsal to lateral line, and 5 scales in same way from origin of adipose dorsal; 6 scales in a vertical series between base of ventral and lateral line; 7 scales between origin of anal and lateral line; 14 scales before dorsal; snout 4 in head, measured from tip of upper jaw; eye  $2\frac{3}{8}$ ; maxillary  $2\frac{3}{8}$ ; interorbital space  $2\frac{3}{8}$ ; least depth of caudal peduncle  $2\frac{1}{2}$ ; pectoral  $1\frac{1}{2}$ ; ventral  $1\frac{3}{8}$ . Maxillary toothless, and reaching front margin of pupil. Rakers about 10 + 15, slender, and a little shorter than filaments. In alcohol brownish, lower surface and sides paler or whitish and everywhere more or less washed with silvery. An ellipsoid blotch of blackish, in length about equal to orbit, on shoulder. Base of caudal pale brownish and median caudal rays brownish. A silvery streak from shoulder to caudal. Iris silvery-brassy. Length  $2\frac{5}{16}$  inches. Para, Brazil. De Schulte Buckow. Coll. J. C. Brevoort.

This example agrees largely with Lütken's excellent figure.

*Astyanax orientalis* (Cope). Fig. 35.

Head  $3\frac{1}{2}$  to  $3\frac{3}{4}$ ; depth  $2\frac{1}{2}$  to  $2\frac{3}{4}$ ; D. III, 9; A. IV, 27 to 29; eye  $2\frac{1}{4}$  to  $2\frac{1}{2}$  in head measured from tip of upper jaw; interorbital space  $2\frac{1}{3}$ . Body well compressed. Snout broad, with convex surface. Teeth as usual in the genus. Maxillary toothless. Tongue thick, fleshy and little free. Interorbital space broad and convex. Gill-opening extends nearly opposite front margin of orbit. Rakers 9 + 14, lanceo-

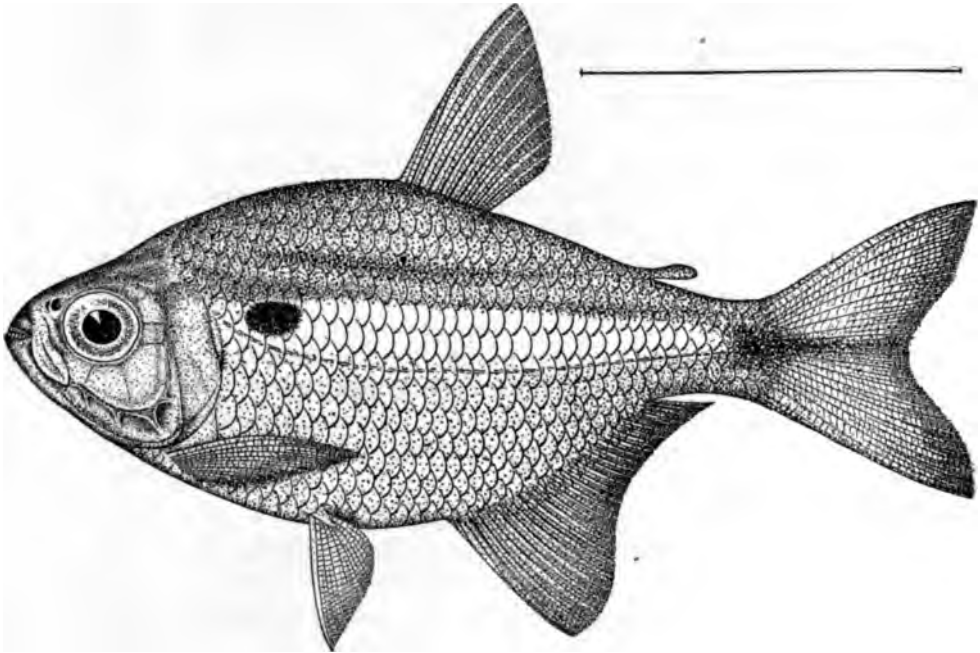


Fig. 35.—*Astyanax orientalis* (Cope).

late, and much shorter than filaments, which are  $\frac{5}{7}$  of orbit. A few striæ on each scale. Tubes in lateral line simple. Vent close in front of anal. Color in alcohol brownish, peritoneum showing through paler. Fins all pale brownish. Lower side of head silvery. An elongate blackish-brown humeral blotch and a similar shade at base of caudal continued out on median rays. A rather indistinct silvery band from shoulder to base of caudal. Length of largest, with damaged caudal,  $2\frac{1}{2}$  inches. Paramaribo, Dutch Guiana. Dr. Charles Hering.

These examples seem to agree best with *Tetragonopterus orientalis* Cope. The discrepancies in the depth of the body may be accounted for by age, as the younger ones are more elongate. The anterior anal rays are however much longer than the others. The eye was evidently found to be 3 in the head, which also may possibly be attributed to age, though my examples show it but a little less than interorbital space.

*Tetragonopterus viejita* Valenciennes may be closely related or identical, as it agrees in some respects, though it is impossible to consider it on account of the imperfect diagnosis.

***Astyanax rutilus* (Jenyns).**

*Tetragonopterus rutilus* Cope, Proc. Amer. Philos. Soc. Phila., XXXIII, 1894 (January 5), p. 87. Brazilian province of Rio Grande do Sul. H. Smith.

Head  $3\frac{3}{4}$  to  $4\frac{1}{2}$ ; depth  $2\frac{2}{3}$  to  $2\frac{3}{4}$ ; D. III, 9, rarely III, 10; A. IV, 25, I to IV, 28, I, usually 25 or 26 developed rays, rarely 27 or 28; scales 35 to 40 in lateral line to base of caudal, usually 37 or 38, and 3 more on latter; 7 scales in an oblique series back from origin of dorsal to lateral line, rarely 8; 5 or 6 scales, usually latter, from base of ventral to lateral line; usually 6 scales from origin of anal, not counting those on base of fin, to lateral line; 15 or 16 scales before dorsal; length of 12 specimens ranging from 2 to 6 inches.

I differ with Cope concerning the statement that this species resembles *Astyanax jequitinhonæ* (Steindachner). Most of my specimens agree quite well with the latter's figure of *A. rutilus*.

***Astyanax jacuhiensis* (Cope).**

*Tetragonopterus jacuhiensis* Cope, Proc. Amer. Philos. Soc. Phila., XXXIII, 1894 (January 5), p. 88, Pl. 6, fig. 6. Cotypes, 21,606 to 21,611; 21,683 to 21,703; 21,912 (type) to 21,916, A. N. S. P. The Jacuhy (Brazilian province of Rio Grande do Sul). H. H. Smith.

Head  $3\frac{3}{4}$ ; depth  $2\frac{1}{10}$ ; D. III, 9; A. IV, 28, I; scales 35 in lateral line to base of caudal, and 2 more on latter; 6 scales obliquely back from origin of dorsal to lateral line; 8 scales in a vertical series between origin of anal in lateral line; pectoral  $1\frac{1}{2}$  in head; ventral  $1\frac{1}{2}$ ; snout  $3\frac{3}{4}$  in head measured from tip of upper jaw; eye  $3\frac{1}{2}$ ; maxillary  $2\frac{3}{4}$ ; interorbital space  $2\frac{3}{4}$ . Body compressed. Predorsal and postventral regions with low median keel, postdorsal rounded and preventral with a low keel on each side. Lips rather fleshy. Teeth as usual. Tongue small, rounded, and little free in front. No maxillary teeth. Interorbital space convex and rather broad. Gill-opening forward to anterior nostril. Rakers 9 + 12?, longest  $\frac{3}{4}$  of filaments, which are  $\frac{3}{4}$  of orbit. Scales striate. Tubes in lateral line simple. Color in

alcohol dull brownish, back darker than lower surface and everywhere more or less sheened with dull silvery. A dusky blotch at base of caudal and another rounded one on humeral region. Former extends midway on side of caudal peduncle, and medianly out on caudal. Humeral spot in a pale area bordered posteriorly with dusky. Also a dusky streak sloping down from humeral spot towards pectoral. On scales just behind gill-opening above base of pectoral a dusky shade. Fins all pale brownish. Iris brownish with a chestnut ring. Length, caudal damaged,  $4\frac{1}{2}$  inches. Type.

The other cotypes show: Head  $3\frac{1}{4}$  to  $3\frac{3}{4}$ ; depth 2 to  $2\frac{1}{4}$ ; D. III, 8 rarely, usually, III, 9, and occasionally III, 10; A. IV, 21, I to IV, 27, I, usually 25, I, or 26, I; scales 31 to 34 in lateral line to base of caudal, and mostly 2 or 3 more on latter; 6 to 8 scales obliquely back from origin of dorsal to lateral line, usually 7; 5 to 7 scales obliquely or vertically between origin of ventral and lateral line, usually 6, less frequently 7, and rarely 5; 12 to 16 scales before dorsal, mostly 14, sometimes 13, less frequently 15 and rarely 12 or 16; pectoral  $1\frac{1}{2}$  to  $1\frac{1}{4}$  in head; ventral  $1\frac{1}{4}$  to  $1\frac{3}{4}$ ; total length of specimens  $1\frac{1}{2}$  to  $4\frac{1}{2}$  inches. Cope's figure fails to indicate the anterior anal rays as a little longer than the others. The young appear more evenly ellipsoid than the adults.

*Astyanax atahualpianus* sp. nov. Fig. 36.

*Tetragonopterus agassizii* Cope, Proc. Amer. Philos. Soc. Phila., XVII, 1877-78 (May 17, 1878), p. 691. Near Pebas. Prof. J. Orton.

Head  $3\frac{3}{4}$ ; depth  $2\frac{1}{4}$ ; D. III, 9; A. III, 21; P. I, 11; V. I, 7; scales (squamation damaged) about 24? in lateral line to base of caudal, and 2 or 3 more evidently on latter; about 6? scales obliquely back from origin of dorsal to lateral line; about 4? scales vertically from origin of anal to lateral line; width of head about  $2\frac{1}{2}$  in its length; depth of head, over middle of orbit,  $1\frac{1}{2}$ ; mandible  $2\frac{1}{4}$ ; least depth of caudal peduncle  $2\frac{3}{4}$ ; snout  $3\frac{3}{8}$  in head, measured from tip of upper jaw; eye  $2\frac{3}{8}$ ; maxillary 2; interorbital space  $2\frac{1}{4}$ .

Body elongate, rather ellipsoid, well compressed, upper profile perhaps a little more convex, and greatest depth apparently at origin of dorsal. Caudal peduncle compressed, and its least depth about equal to length.

Head moderately short, deep, compressed, muzzle blunt and heavy, and upper profile nearly straight from snout to occiput. Snout short, rather narrow, and surface convex. Eye circular, a little anterior and superior. Mouth large and a little inclined. Maxillary long, oblique, its greatest width a trifle more than half of pupil, and its posterior

extremity reaching beyond front margin of orbit, but not till opposite front margin of pupil. Mandible strong, protruding beyond tip of upper jaw, and rami not elevated inside of mouth. Lips rather thin. Teeth in jaws mostly quidentate, 4 on each side, in an outer series above, and those forming mandibular series large and powerful. Maxillary with 2 basal denticles. Tongue apparently flattened, a little elongate and hardly free. Nostrils, as usual, in front of eye above. Interorbital space moderate, and convex. Opercle deep, and upper posterior edge emarginate. Greatest width of infraorbital rim greater than greatest exposed breadth of opercle.

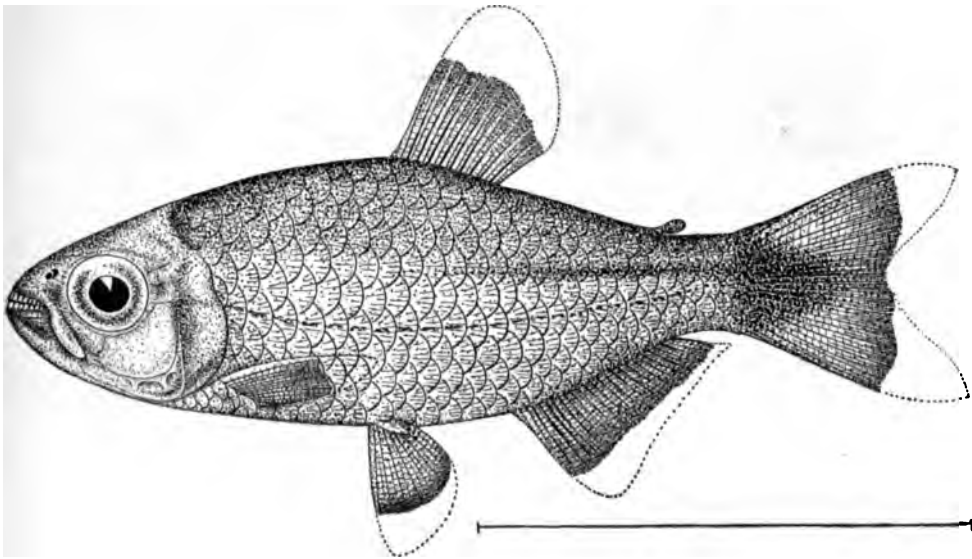


Fig. 36.—*Astyanax atahualpianus* Fowler.

Gill-opening extending forward about opposite posterior extremity of maxillary. Rakers about  $8 + 11?$ , lanceolate, and shorter than filaments which are about  $\frac{4}{5}$  of orbit. Isthmus narrowly triangular.

Scales mostly fallen, cycloid, each with several striæ, thin, large, not narrowly imbricated, and apparently disposed in longitudinal series parallel with lateral line. Base of anal apparently with a low sheath of small scales. Base of caudal also covered with small scales. Lateral line apparently as usual or a little decurved, then sloping up to base of caudal, though a little low at first along side of caudal peduncle. Tubes simple.

Origin of dorsal much nearer base of caudal than tip of mandible

and anterior rays apparently well elevated. Anal inserted just behind base of last dorsal ray, also nearer base of caudal than origin of pectoral, and anterior rays apparently elongated. Caudal forked, lobes apparently pointed. Pectoral small, evidently not attaining ventral(?). Ventral inserted a little before origin of dorsal or nearly midway between origin of pectoral and that of anal, and perhaps reaching(?) latter.

Color in alcohol brownish, back darker, and side evidently silvered. Fins brownish, except base of caudal which is largely blackish. No trace of humeral blotch. Iris brownish.

Length  $1\frac{1}{8}$  inches (caudal damaged).

Type, No. 21,435, A. N. S. P. Near Pebas, Peru. Prof. J. Orton. Coll. of 1877. Prof. E. D. Cope. Also paratype, No. 21,436, A. N. S. P., with same data. Both in poor preservation.

This form is very close to *Astyanax agassizii* (Steindachner), differing, as Cope long pointed out, in the longer body. It also has fewer anal radii.

(Named for Atahualpa, among the last of the unfortunate Incas of Peru, who was strangled by the Spaniards at Cajamarca, August 29, 1533.)

***Astyanax oligolepis* (Günther). Fig. 37.**

Width of head  $1\frac{1}{2}$  in its length; interorbital space  $2\frac{1}{4}$ . Body compressed. Predorsal region with a median rounded ridge, postdorsal and preventral regions rounded, and postventral region a little trenchant. Head compressed. Snout broad with convex surface. Lips rather thin. Teeth as usual, with a small one at base of maxillary. Tongue a little pointed and rather attenuated. Interorbital space broadly convex. Gill-opening forward opposite end of maxillary. Rakers 9 + 11, about  $\frac{1}{4}$  length of filaments which are  $\frac{3}{4}$  of eye. Scales with several radiating striæ. Tubes in lateral line simple. Color in alcohol brownish, evidently discolored greenish. About 8 or 9 longitudinal dark streaks, each one following in courses of scales at their junctions above and below. Fins more or less plain brownish, and dorsal and caudal perhaps a little darker. Iris dull orange-brown. Length  $3\frac{7}{8}$  inches. Peruvian Amazon. Prof. J. Orton Coll. Also 2 other examples.

The above account agrees largely with Dr. Günther's, though the eye is larger and the maxillary extends to the front margin of the eye in his examples. In mine there are indistinct traces of both caudal and humeral spots which I suspect have more or less faded.

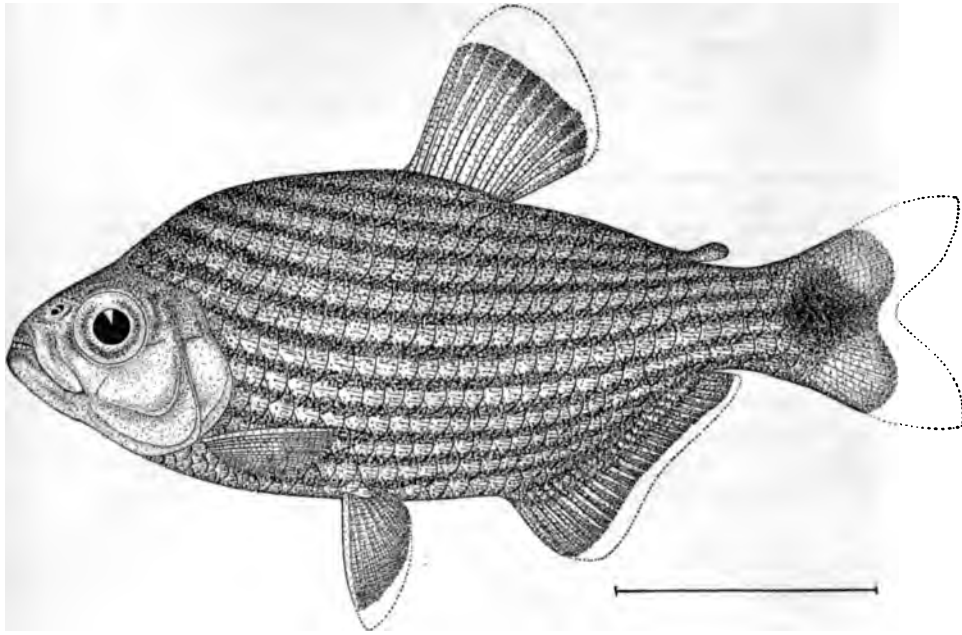


Fig. 37.—*Astyanax oligolepis* (Günther).

***Astyanax abramis* (Jenyns).**

*Tetragonopterus* sp. indet. Cope, Proc. Amer. Philos. Soc. Phila., XVII, 1877-78 (May 17, 1878), p. 691. Peruvian Amazon. Prof. J. Orton.

Head 3 to  $3\frac{3}{4}$ ; depth  $2\frac{2}{3}$  to 3; D. III, 9; A. IV, 24? (usually more) to 30; scales about 44 to 48 (according to pockets) in lateral line to base of caudal and usually 3 more on latter; 19 to 21 scales before dorsal, the usual number 19 or 20; 10 to 12 scales in an oblique series back from origin of dorsal to lateral line; about 7? to 9 scales in a vertical series from origin of anal to lateral line; eye  $2\frac{1}{4}$  to  $3\frac{1}{4}$  in head, measured from tip of upper jaw; length of specimens (caudals damaged)  $2\frac{1}{4}$  to  $3\frac{1}{4}$  inches. A tooth at base of maxillary. Coll. of 1873. A series of 25 poorly preserved examples.

The larger examples are deeper and have the anal beginning a little before bases of last dorsal rays. Pectoral reaching a little beyond origin of ventral, and latter reaches that of anal. Caudal and humeral blotches evident in alcohol. Pectoral and ventral blackish, and anal also finely speckled with dusky.

Although certain minor discrepancies may be noted between Jenyns' figure and these examples I believe they are identical. Jenyns

fails to indicate either the humeral or the caudal blotch which are here very distinct.

Dr. Eigenmann has recently recorded under the name *Pæcilurichthys abramis* some specimens from Paraguay which apparently are the present species.

***Tetragonopterus chalcus* Agassiz.<sup>1</sup>**

Cope, Proc. Acad. Nat. Sci. Phila., 1871 (1872), p. 260. Ambyiacu River, Equador. John Hauxwell.—Cope, *l.c.*, p. 291. Between the mouth of the Rio Negro and the Peruvian Amazon or Ucayale River. Robert Perkins.—Cope, Proc. Amer. Philos. Soc. Phila., XVII, 1877-78 (May 17, 1878), p. 691. Marañon. Prof. J. Orton.  
*Tetragonopterus ortonii* Cope, *l.c.* XI, 1869-70 (August 16, 1870), p. 566. Pebas, Peru. John Hauxwell.

Head 3 to 3½; depth 1½ to 2; D. III, 9; A. IV, 30, I to IV, 36, I, usually 33 developed rays, frequently 34, and other numbers rare or exceptional; 29 to 31 scales in lateral line to base of caudal, usually 30, and 3 more on latter; 8 scales in an oblique series back from origin of dorsal to lateral line; 5 scales from root of ventral to lateral line; 6 scales from origin of anal, not counting any on fin, to lateral line; length of 13 examples from 2¼ to 4 inches. Hauxwell, Perkins and Orton.

The example recorded from Pebas, eastern Peru, by Cope as *T. ortonii* is identical. It shows: Head 2½; depth about 1½; D. III, 9; A. IV, 33?; scales (squamation damaged) about 28? in lateral line to base of caudal; snout about 4 in head, measured from tip of upper jaw; eye 2½; interorbital space 3. A dusky blotch at base of caudal. Length (caudal damaged) 2¼ inches. John Hauxwell.

*Tetragonopterus ortonii* Gill is possibly this species, though I have not examined the type.

***Tetragonopterus ovalis* (Günther). Fig. 38.**

*Tetragonopterus chalcus* Cope, Proc. Amer. Philos. Soc. Phila., XVII, 1877-78 (May 17, 1878), p. 691. Marañon. Prof. J. Orton.

Interorbital space 2½ in head. Body compressed. Predorsal region with a median keel, postdorsal region rounded, preventral region a little broad and flattened with a lateral keel on each side, and postventral region trenchant. Snout broad and convex. Several small teeth at base of maxillary inside. Some teeth in inner series of upper jaw with more than 5 cusps. Tongue fleshy, thick and little free. Interorbital space broad and convex. Gill-opening forward opposite anterior margin of orbit. Rakers 9 + 11, lanceolate, half of filaments, which are ¼ of eye. Each scale with several radiating striæ. Tubes in lateral line simple. Vent shortly before anal. Color in alcohol with scales faded brassy-brown, back darker, also top of head. Side of head burnished silvery. Fins pale brownish.



Where scales fell from trunk a broad silvery band exposed, extending from eye to middle of base of caudal. Humeral and caudal spots if present in life now faded entirely. Iris reddish-brown. Length  $2\frac{3}{4}$  inches. Coll. of 1877.

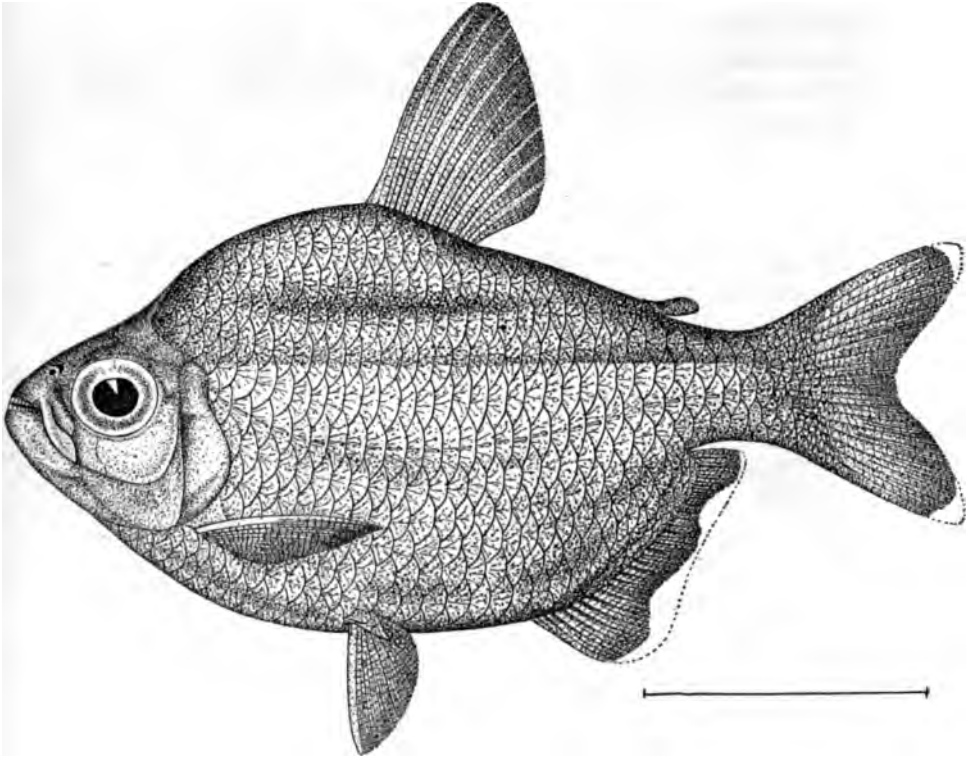


Fig. 38.—*Tetragonopterus ovalis* (Günther).

***Plethodectes erythrurus* Cope.**

Proc. Amer. Philos. Soc. Phila., XI, 1869-70 (August 19, 1870), p. 563, figs. 6 and 6a. Type, No. 8,032, A. N. S. P. Pebas, Equador. John Hauxwell.

*Chalceus erythrurus* Cope, Proc. Acad. Nat. Sci. Phila., 1871 (1872), p. 262 (type).

Width of head  $2\frac{1}{4}$  in its length; interorbital space  $2\frac{3}{4}$  in head measured from tip of upper jaw. Body compressed, and dorsal edge apparently rounded. Head compressed. Snout about as broad as long, and rounded when viewed from above. Gill-opening reaching tip of maxillary. Rakers 7 + 9?, little shorter than filaments, which equal pupil. Each scale with about 5 striæ. Tubes in lateral line

simple. Color in alcohol brown, abdomen and lower surface of head paler, especially that of muzzle. Upper surface of head brown. Dorsal, anal and ventral dusky-brown, latter deepest. Caudal, except dusky-brown median rays, pale brownish. Pectoral pale brownish. Lips brownish. Iris silvered brown. Length  $2\frac{9}{16}$  inches (caudal damaged). Type.

Cope states concerning the scales "transverse (above l. line) 16," which is surely wrong as he already had stated "scales large, l. series 6 at ventrals."

**PELLEGRININA** gen. nov.

Type *Pellegrinina heterolepis* sp. nov.

This genus differs from *Alestes*, *Brachyalestes* and *Brycinus* in the short anal basis and large dorsal scales.

(Named for Dr. J. Pellegrin, of the Museum of Natural History, Paris, author of many important contributions to Ichthyology.)

*Pellegrinina heterolepis* sp. nov. Fig. 39.

Head 3; depth  $3\frac{1}{4}$ ; D. III, 10; A. III, 9, 1; P. II, 15; V. II, 8; scales about 29? (squamation damaged) in lateral line to base of caudal, and several more on latter; 4 scales between origin of dorsal and lateral line; 3 scales between origin of adipose fin and lateral line; 2 scales between base of ventral and lateral line; 2 scales between origin of anal and lateral line; 9 scales before dorsal; width of head 2 in its length; depth of head over posterior margin of orbit  $1\frac{1}{4}$ ; snout  $3\frac{1}{4}$ ; eye  $3\frac{3}{4}$ ; maxillary 3; mandible  $2\frac{1}{4}$ ; interorbital space  $2\frac{1}{4}$ ; third dorsal ray  $1\frac{1}{2}$ ; third anal ray  $1\frac{1}{4}$ ; least depth of caudal peduncle 3; pectoral  $1\frac{1}{4}$ ; ventral  $1\frac{1}{4}$ .

Body elongate, rather slender, well compressed, profiles similarly and slightly convex with greatest depth about middle of depressed pectoral. Predorsal region with a very obsolete median keel. Breast flattened, and preventral region otherwise similar to predorsal. Postventral region with a median obsolete keel, also postanal. Postdorsal region rounded, keel not evident. Caudal peduncle small, well compressed, and its length a little less than least depth.

Head elongate, broad above, sides flattened and becoming somewhat constricted below, profiles similar. Snout broad, rounded when viewed from above. Eye large, circular, anterior and high. Jaws large, about even. Maxillary rather small, narrow, reaching a little past front of orbit though not to front rim of pupil. Teeth in upper jaw triserial, outer series 17, slender and tridentate, and second series

of 4 anteriorly resembling inner series except smaller. Inner series of upper teeth 11, broad, compressed, quidentate and surface crenulate. Mandible with about 11 robust quidentate teeth in an outer series, and a recurved canine forming an inner series, one on each side of symphysis. Outer series of mandibular teeth continued along each ramus of mandible posteriorly, where it is also not elevated inside mouth, as very weak denticles. Along edge of maxillary some weak denticles, most developed and crowded towards its base. Buccal membranes in mouth rather broad. Tongue small, little free. Nostrils together, close in front and falling nearly opposite middle in depth

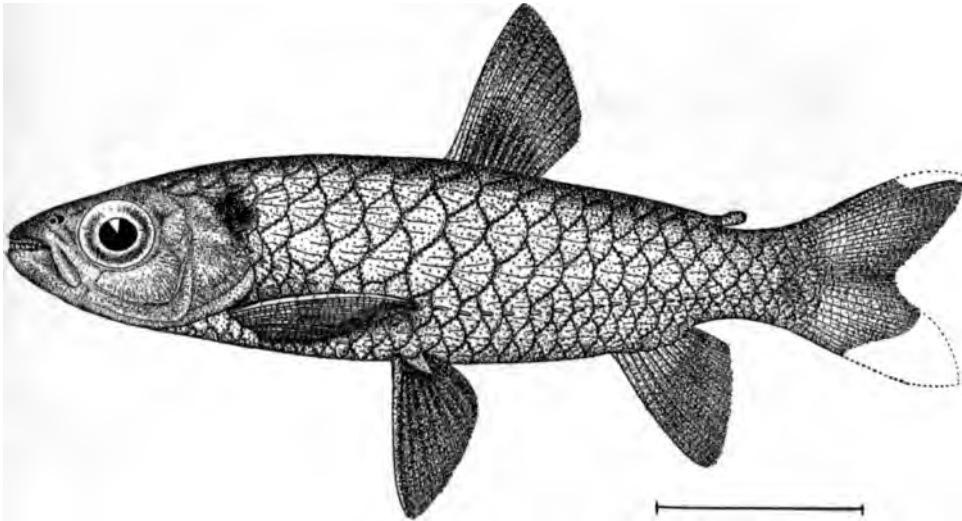


Fig. 39.—*Pellegrinina heterolepis* Fowler.

of eye. Interorbital space broad and but slightly convex, not elevated. Infraorbital broadest in chain, and its greatest exposed width not quite equal to that of opercle. Bones in orbital chain, and opercle, with slight striæ marginally.

Gill-opening extending forward about opposite front rim of pupil. Gill-rakers about 7 + 9 weak points less than half of pupil in length. Filaments about equal to pupil. Isthmus narrow, with a convex surface.

Scales cycloid of various size, those on upper half large, and lower reduced and of crowded appearance. Each scale with radiating striæ. Scales along base of anal and caudal small. Lateral line of simple tubes, decurved and extending rather low till on base of caudal.

Origin of dorsal falling nearly midway between front margin of eye and base of caudal, and third ray apparently longest, others graduated down. Adipose dorsal inserted near last fourth in space between origin of dorsal and base of caudal, and its length about  $\frac{3}{4}$  of orbit. Anal inserted well behind base of dorsal or nearly midway between origin of dorsal and base of caudal, and graduated from about fourth ray, which is apparently longest. Caudal emarginate and lobes apparently pointed. Pectoral long, reaching a little beyond ventral. Ventral inserted a little in front of dorsal, and reaching nearly  $\frac{3}{4}$  of space to anal.

Color in alcohol pale brownish, upper surface apparently scarcely darker. Fins plain pale brownish, dorsal with a brownish blotch basally, made up of specks, also one on anal, and ventrals dotted brownish. A large dusky humeral blotch. Iris brassy.

Length  $4\frac{1}{4}$  inches (caudal damaged).

Type, No. 8,150, A. N. S. P. Probably some part of West Africa. A single example.

(*Erepos*, various; *λεπίς*, scale.)

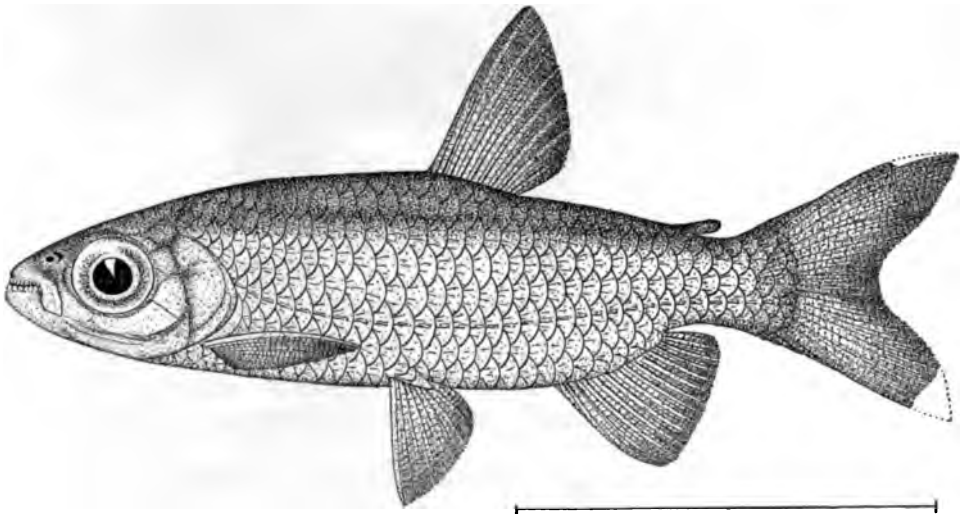


Fig. 40.—*Brachyalestes nurse rüppellii* (Günther).

*Brachyalestes nurse rüppellii* (Günther). Fig. 40.

*Alestes rüppellii* Günther, Proc. Zool. Soc. London, 1896 (February 4), p. 223. Lake Rudolf. Dr. A. D. Smith.

Width of head  $2\frac{1}{2}$  in its length; interorbital space  $3\frac{1}{2}$  in head measured from tip of upper jaw. Body well compressed and edges apparently

all rounded. Head compressed. Snout short, a little broader than long, and edge strongly convex as viewed from above. Mouth broad. No maxillary teeth. Tongue small and hardly free. Interorbital space a little convex. Gill-opening reaches front margin of pupil. Rakers 12 + 17?, slender, about  $\frac{2}{3}$  of orbit and shorter than filaments. Each scale with 1 or more inconspicuous radiating striæ. Tubes in lateral line simple. Color in alcohol more or less silvery, and back and upper surface of head brown with pale purple reflections. Jaws pale brownish, also fins, dorsal and caudal hardly darker. Iris brassy. Length  $2\frac{1}{4}$  inches.

*Brachyalestes affinis* (Günther). Fig. 41.

*Alestes affinis* (Günther), Proc. Zool. Soc. London, 1896 (February 4), p. 223. Shebéli River, Africa. Dr. A. D. Smith.

Width of head  $1\frac{1}{2}$  in its length; interorbital space  $2\frac{1}{2}$  in head measured from tip of upper jaw. Body well compressed, and edges apparently all rounded. Head robust. Snout convex on surface, and obtuse when viewed above. Mouth broad. No maxillary teeth.

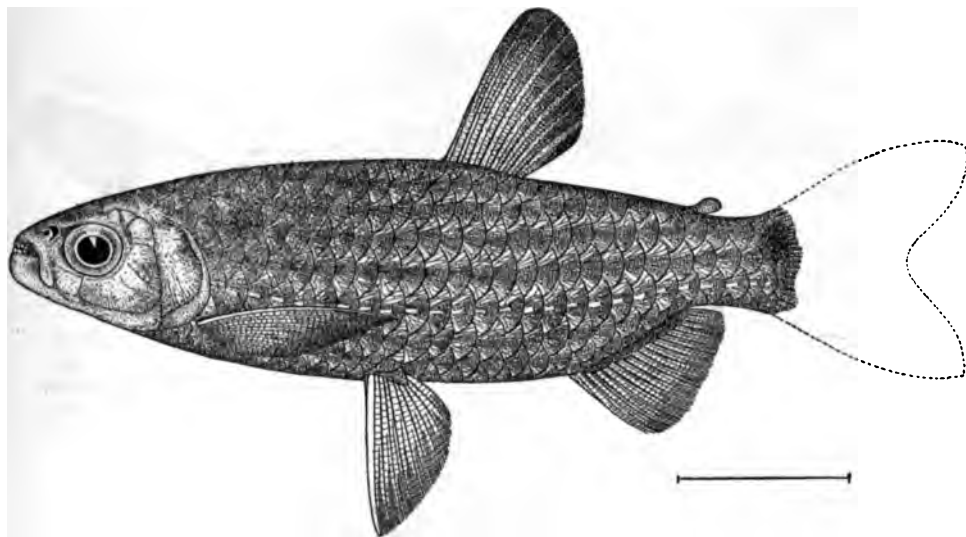


Fig. 41.—*Brachyalestes affinis* (Günther).

Tongue small and not free. Interorbital space broad and evenly convex. Gill-opening reaching front rim of pupil. Rakers 12 + 15, slender, and longest  $\frac{2}{3}$  of pupil. Each scale with many reticulating striæ. Color in alcohol faded plain pale brownish, and back and upper

surface but a shade darker. Traces of a broad silvery lateral band, about equal to orbit in width, extends to caudal. Traces of a brownish blotch at shoulder and of another at base of upper caudal lobe. Fins pale brownish, dorsal and caudal hardly darker. Iris brassy-brown. Length (caudal damaged)  $4\frac{3}{4}$  inches.

*Brycon capito* Cope. Fig. 42.

Proc. Acad. Nat. Sci. Phila., 1871 (1872), p. 261. Type, No. 8,058, A. N. S. P. Ambyiacu River John Hauxwell.

Width of head  $2\frac{1}{2}$  in its length; interorbital space 3 in head measured from tip of upper jaw. Body well compressed. Head compressed. Snout broader than long, depressed above. Teeth in mandible largest, especially 6 anterior ones which are quidentate. Rami not elevated, with small simple conic teeth like those in front of upper jaw and becoming graduated posteriorly. Outer series of teeth in upper jaw like those on side of lower. Smaller ones continued out on edges of maxillaries in a single series its entire length, though more properly a

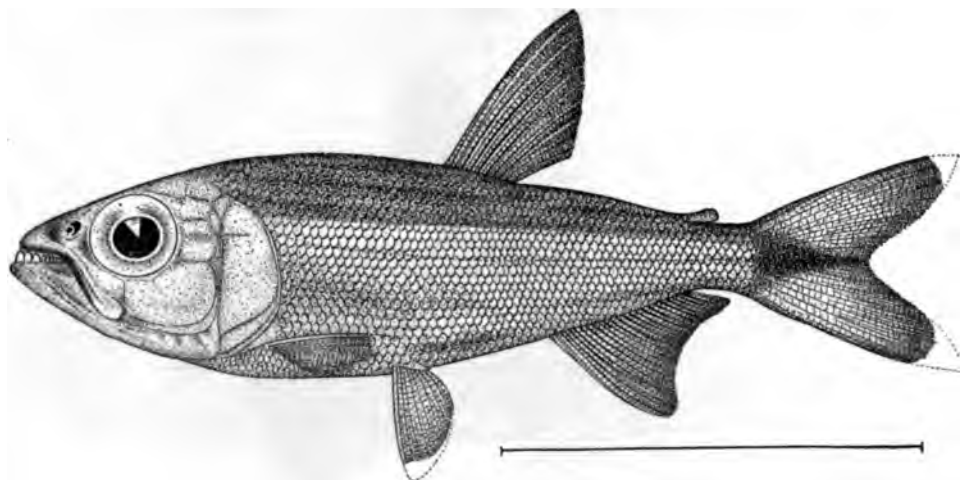


Fig. 42.—*Brycon capito* Cope.

continuation of inner series in upper jaw. In front of upper jaw teeth somewhat triserial with innermost quidentate and enlarged. An inner series formed of 2 conic teeth at symphysis. Tongue narrow anteriorly, little free. Interorbital space broad and flat. Gill-opening to first  $\frac{3}{4}$  of eye. Rakers  $9 + 15$ , slender, and shorter than longest filaments, which are  $\frac{3}{4}$  of eye. Vent close in front of anal. Color in alcohol brownish-gray, becoming leaden on sides and whitish below. Fins pale brownish, and middle rays of caudal darker brown than rest of fin. Side of head silvery. Iris brassy-brown. Length  $2\frac{1}{4}$  inches.

***Brycon melanopterus* (Cope).**

*Megalobrycon melanopterus* Cope, Proc. Acad. Nat. Sci. Phila., 1871 (1872), p. 262, Pl. 13, fig. 1. Cotypes, Nos. 8,035 (type) and 8,036, A. N. S. P. Ambyiacu River. John Hauxwell.

Width of head 2 in its length; interorbital space  $2\frac{1}{2}$ . Body compressed, and edges apparently all rounded. Head becoming more or less constricted below. Snout broad, rounded when viewed above. Mouth broad. Outer enlarged mandibular teeth 8, quindentate, and lateral series becoming smaller posteriorly. An inner lateral series of mandibular teeth, small, and at symphysis a small conic tooth inside. Maxillary toothed, its entire edge in a single series. Teeth in upper jaw triserial anteriorly, laterally biserial, and each of inner series at least tridentate, those in third anterior series enlarged and quindentate. Tongue thick, fleshy and little free. Interorbital space broadly convex. Gill-opening to about first  $\frac{1}{4}$  of eye. Rakers about 8 + 13, lanceolate, and longest  $\frac{2}{3}$  of longest filaments, which are  $\frac{1}{4}$  of eye. Scales strongly striate and finely ciliate. Color in alcohol pale brownish, back and upper surface of head a little deeper colored. Fins pale brownish, and dorsal, caudal and anal tinted a little brownish. Along middle of upper caudal lobe longitudinally a dusky-brown blotch, deepest at base of lobe. This margined below diffusely with grayish-white. Along base of anal a brownish shade. Iris brassy-brown. Length  $6\frac{1}{2}$  inches (caudal damaged). Type.

Also 4 examples from the Peruvian Amazon from Prof. James Orton Coll.

Though I allow the above specimens of this species as distinct from *Megalobrycon cephalus* Günther, it is possible that they may be found identical. Cope pointed out that *M. melanopterus* differs in the outer series of teeth in the upper jaw being more than double the size of those on the maxillary, as stated for *M. cephalus* by Dr. Günther. The apparently uniform coloration is a feature of striking difference, and as Dr. Günther's examples were 13 inches long, may be one of age. *Brycon falcatus* Müller and Troschel, from Guiana, is also related.

***Chalcinus albus* (Cope).**

*Triportheus albus* Cope, Proc. Acad. Nat. Sci. Phila., 1871 (1872), p. 264, Pl. 14, fig. 3. Type, No. 21,234, A. N. S. P. Ambyiacu River. John Hauxwell.

Width of head  $2\frac{1}{2}$  in its length; interorbital space 3 in head measured from tip of upper jaw. Body strongly compressed and preentral region trenchant. Snout with convex surface, and rounded when viewed from above. Teeth in upper jaw mostly biserial, or only irregularly triserial, quindentate, and median inner series expanded

and enlarged. Mandibular teeth uniserial, except 2 simple conic ones in front at symphysis forming an inner series. On each ramus of mandible 4 anterior enlarged and distinctly quidentate teeth. At base of maxillary 2 small denticles. Tongue rather narrow, a little fleshy, rounded and hardly free in front. Interorbital space rather broad and convex. Gill-opening reaching opposite anterior margin of pupil. Rakers 13 + 22, slender, fine, shorter than filaments, which are  $\frac{4}{5}$  of orbit. Color in alcohol faded brownish, more or less leaden on sides, and side of head and abdomen silvered. Fins pale brownish, middle of caudal dusky. Lips brownish. Iris brownish. Length  $2\frac{1}{2}$  inches (caudal damaged).

*Chalcinus angulatus* (Agassiz).

*Chalcinus brachypomus* Cope, Proc. Amer. Philos. Soc. Phila., XI, 1869-70 (August 19, 1870), p. 566. Pebas, Eastern Peru. John Hauxwell.—Cope, l.c. Para. De Schulte Buckow.

*Triportheus flavus* Cope, Proc. Acad. Nat. Sci. Phila., 1871 (1872), p. 264, Pl. 14, fig. 1. Cotypes, Nos. 8,077 (type) to 8,080, A. N. S. P. Ambyiacu River. John Hauxwell.

*Triportheus nematurus* Cope, Proc. Amer. Philos. Soc. Phila., XVII, 1877-78 (May 17, 1878), p. 692. Peruvian Amazon. Prof. J. Orton.

Head  $3\frac{1}{2}$ ; depth  $2\frac{1}{2}$ ; D. II, 9; A. IV, 27, 1; scales 34 in lateral line to base of caudal, and apparently 4 more on latter; 6 scales obliquely back from origin of dorsal to lateral line; 3 scales between origin of anal and lateral line; 16 scales before dorsal; pectoral  $2\frac{1}{2}$  in head and trunk; mandible 3 in head, measured from tip of lower jaw; least depth of caudal peduncle 3; ventral  $1\frac{2}{3}$ ; snout 4 in head, measured from tip of upper jaw; eye  $3\frac{1}{2}$ ; maxillary 3; interorbital space 3. Rakers 16 + 37, slender, fine, more or less subequal, and longest about  $\frac{3}{4}$  of longest filaments which are  $\frac{3}{4}$  of orbit. Lower lip with a fleshy cirrus on each side about half of orbit. In alcohol brassy-brown everywhere with more or less silvered reflections. Dorsal, caudal and pectoral dusted with dull brownish. Iris brownish. Length  $6\frac{1}{2}$  inches (caudal damaged). Type.

Other examples in the collection are one from Pebas in eastern Peru, John Hauxwell; one from Para in Brazil, De Schulte Buckow; one identified as *Triportheus nematurus* from the Peruvian Amazon, Prof. James Orton, in the collection of 1873.

All the examples now before me show the following extent of variation: Head  $3\frac{1}{2}$  to  $4\frac{1}{2}$ ; depth  $2\frac{1}{2}$  to  $3\frac{1}{2}$ ; D. II or III, 8 to 10, usually 9, though sometimes 9 or 10; A. III or IV, 25, 1 to 29, 1, usually 27, 1, sometimes 26, 1 or 28, 1, and rarely 25, 1 or 29, 1; scales 30 to 34 in lateral line to base of caudal, usually 3 or 4 on latter; 6 or 7 scales obliquely back from origin of dorsal to lateral line, usually 6; 3 or 4 scales between



origin of anal and lateral line; 14 to 17 scales before dorsal, usually 15 or 16; snout 4 to  $4\frac{1}{2}$  in head, measured from tip of upper jaw; eye  $2\frac{1}{2}$  to  $3\frac{1}{2}$ ; maxillary  $2\frac{1}{2}$  to  $3\frac{1}{2}$ ; length of depressed pectoral (mostly damaged) about  $2\frac{1}{2}$  to 3; length of examples  $3\frac{1}{2}$  to  $6\frac{1}{2}$  inches.

Cope's figure, which however may not have been drawn from the specimen which is here restricted as the type, differs in having the abdominal profile more undulate, the absence of mandibular cirri, the radii of anal anteriorly much lower, and the adipose fin too small. The mandibular cirri are present in most every case examined, though in the adult they are much shorter and inconspicuous.

Granting Dr. Günther's argument concerning Agassiz's figure of *Chalcinus angulatus*, it is reasonably certain that my specimens belong to that species.

*Chalcinus brachipomus* Valenciennes. Fig. 43.

Width of head 2 in its length; interorbital space  $2\frac{1}{2}$  in head measured from tip of upper jaw. Body strongly compressed. Back rounded along edge. Preventral and postventral regions trenchant. Snout broad, surface convex, and rounded when viewed above. Teeth in

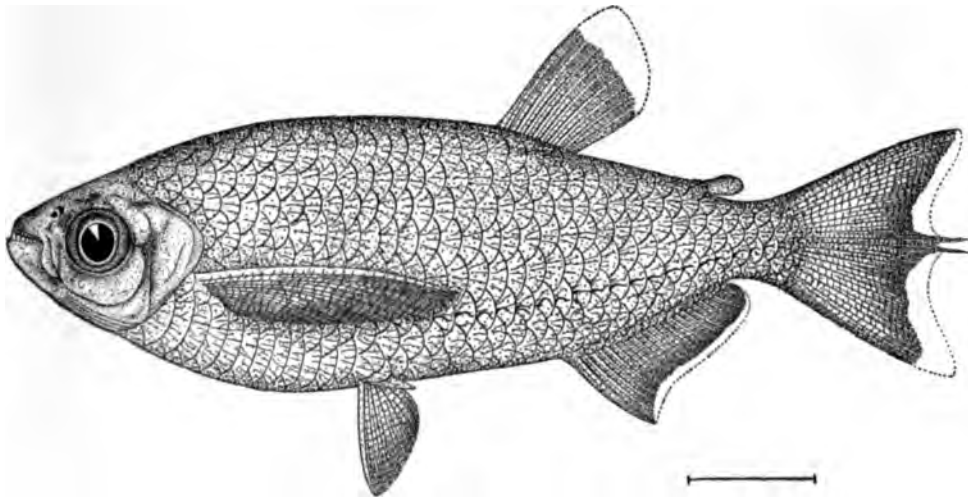


Fig. 43.—*Chalcinus brachipomus* Valenciennes.

upper jaw biserial, 3 median ones of inner series compressed and somewhat enlarged. Mandible with 5 teeth on side of each ramus anteriorly enlarged, and at symphysis 2 conical teeth. At least 2 small teeth on inner base of maxillary more or less concealed by lips. Tongue

thick, fleshy, pointed and tip little free. Interorbital space rather broad and evenly convex. Gill-opening forward to front of eye. Rakers 19 + 41, longest about  $\frac{1}{4}$  of filaments which are  $\frac{1}{4}$  of eye. Scales all well striated. Tubes in lateral line arborescent and rather long. Color in alcohol brassy-brown, back darker than lower surface. Upper surface of head brownish, sides and below pale or more brassy. Pectoral and dorsal dusted brownish, caudal paler. Ventral and anal whitish. Iris brassy-brown. Length  $7\frac{1}{2}$  inches. Demarara River, British Guiana. E. D. Cope.

This species has apparently been confused, and it is not improbable that *Chalcinus rotundatus* (Jardine) may be found really the name applicable. Jardine's figure and account are, however, too crude and incomplete to permit of certain identification. In fact the anterior position of the dorsal fin as indicated by the figure would point more to *C. angulatus* (Agassiz). Under *C. brachypomus*, the statement "la dorsale est assez reculée sur la dos et presque opposée à l'anale qui est longue et basse" by Valenciennes, may perhaps be better referred to that designated as *C. brachypomus* by Dr. Günther. I see no reason for Prof. Garman indicating Dr. Günther's examples as identical with the one from the Amazons under a new name, which is afterwards accepted by Dr. and Mrs. Eigenmann. These latter writers, and also Prof. Ulrey, unite *Chalceus angulatus* Agassiz with *Chalcinus brachypomus* Valenciennes, a proceeding which I am unable to accept. The latter may be distinguished from the former by the more posterior insertion of the dorsal.

**COSCINOXYRON** gen. nov.

Type *Chalcinus culter* Cope.

Gill-rakers fine, long and numerous on first arch, about 90 to 100. Dorsal inserted well posteriorly, or about last third in length of head and trunk.

(*Κόσκινον*, sieve; *ξυρὸν*, razor; reference to the gill-rakers and cultrate body.)

**Coscinoxyron culter** (Cope).

*Chalcinus culter* Cope, Proc. Acad. Nat. Sci. Phila., 1871 (1872), p. 265, Pl. 14, fig. 3. Type, No. 16,672, A. N. S. P. Ambyiacu River. John Hauxwell.—Cope, Proc. Amer. Philos. Soc. Phila., XVII, 1877-78 (May 17, 1878), p. 692. Peruvian Amazon. Prof. J. Orton.

Width of head  $2\frac{3}{4}$  in its length; interorbital space  $3\frac{1}{4}$  in head measured from tip of upper jaw. Body strongly compressed. Head well compressed, becoming constricted below. Surface of snout somewhat flattened above. Teeth a little small, those in upper

jaw crowded into 2 irregular series, inner a little larger, and all more or less tridentate. No maxillary teeth. Mandibular teeth uniserial, but little larger than those in upper jaw, and at symphysis 2 close behind outer series. Tongue slender, pointed, fleshy and little free. Interorbital space broad and convex. Gill-opening forward opposite anterior margin of eye. Rakers 30 + 65, ciliiform, slender and longer than filaments or  $\frac{1}{4}$  of eye. Color in alcohol plumbeous-brown on back, side and lower surface leaden, and side of head silvered. Fins all diluted brown, pectoral and caudal dusted with dull brownish dots, and median rays of latter all more or less deep brown. Iris brownish. Length 6 inches. Type.

The 2 examples from the Peruvian Amazon show: Head  $3\frac{1}{2}$  to 4; depth  $3\frac{1}{2}$ ; D. II, 9; A. IV, 28 or 29; scales about 40 (squamation injured) in lateral line to base of caudal, and 3 or 4 more on latter; about 8 scales (according to pockets) obliquely back from origin of dorsal to lateral line, and 3 between latter and origin of anal; about 23 to 25 (squamation injured) before dorsal; mandible  $3\frac{1}{2}$  to  $3\frac{1}{4}$  in head; snout  $4\frac{1}{2}$  to  $4\frac{3}{4}$  in head, measured from tip of lower jaw; eye  $4\frac{1}{4}$  to  $4\frac{1}{2}$ ; interorbital space  $3\frac{1}{2}$  to  $3\frac{1}{4}$ ; pectoral 3 in head and trunk; length of fishes (caudal damaged)  $8\frac{1}{2}$  inches.

As with *Triporthus flavus* and *T. albus* Cope's figure does not show the mandibular cirrus, a character present in all of the examples of the present species, though smaller in the larger. The dark median basal blotch on the caudal is also not shown on his figure.

***Pseudocerynopoma doriae* Perugia.**

Cope, Proc. Amer. Philos. Soc. Phila., XXXIII, 1894 (January 5), p. 86.  
Jacuhy (Brazilian province of Rio Grande do Sul). H. H. Smith.

Head  $3\frac{1}{2}$  to 4; depth  $2\frac{3}{4}$  to 3; D. II, 9; A. IV or V, usually V, 30, I to 39, I, usually 34, I, frequently 32, I or 35, I, and only seldom 30, I or 39, I; scales 33 to 40 in lateral line to base of caudal and usually 1 or 2 more on latter; 7 or 8 scales obliquely back from origin of dorsal to lateral line; 6 to 8 scales, usually 7, between origin of anal and lateral line in a vertical series; 16 to 21 scales before dorsals, though usually 18 or 19; snout  $3\frac{1}{2}$  to  $4\frac{1}{4}$  in head, measured from tip of upper jaw; eye 3 to  $3\frac{1}{4}$ ; maxillary  $2\frac{1}{2}$  to  $2\frac{3}{4}$ ; interorbital space  $2\frac{1}{4}$  to 3; pectoral  $2\frac{3}{4}$  to  $3\frac{1}{2}$  in head and trunk; length of body (caudals damaged)  $1\frac{1}{2}$  to  $2\frac{1}{2}$  inches. In all 17 examples.

Some, apparently females, do not appear to have the dorsal much enlarged, and the anal also smaller. Fully developed males show the distal end of each elongated anterior anal ray with a single series of small tubercles, evidently a character of breeding.

Subgenus *GASTROPELECUS* Bloch.

Upper anterior profile straight.

*Gasteropelecus sterniela* (Linnaeus).

Head  $3\frac{1}{2}$ ; greatest depth  $1\frac{1}{2}$ ; D. II, 8; A. III, 30; scales 30? (squamation injured) in a lateral series from gill-opening above to base of caudal; about 18 scales before dorsal; 13 scales in a transverse series between origin of dorsal and that of anal; 17? scales from gill-opening at origin of pectoral to that of ventral; width of head about 2 in its length; mandible  $2\frac{1}{2}$ ; snout  $4\frac{1}{2}$  in head measured from tip of upper jaw; eye  $3\frac{1}{2}$ ; interorbital space  $2\frac{1}{4}$ . Length  $2\frac{3}{4}$  inches. Surinam. Bonaparte Coll. (No. 456.) Dr. T. B. Wilson.

## THORACOCCHARAX subgen. nov.

Type *Gasteropelecus stellatus* Kner.

Anterior profile of back convex.

(*θαλαξ*, cuirass; *χαλαξ*, Charax.)

*Gasteropelecus stellatus* Kner.

Cope, Proc. Amer. Philos. Soc. Phila., XI, 1869-70 (August 19, 1870), p. 566. Pebas, Eastern Peru. John Hauxwell.—Cope, Proc. Acad. Nat. Sci. Phila., 1871 (1872), p. 265. Ambyiacu River. John Hauxwell.

Head  $3\frac{1}{2}$  to  $3\frac{3}{4}$ ; depth  $1\frac{1}{2}$  to  $1\frac{3}{4}$ ; D. II, 12 to II, 15, usually II, 13; A. III, 35 to III, 39; scales (squamation damaged) 18? to 20 in a lateral series from gill-opening to base of caudal; pectoral (damaged) about  $1\frac{1}{2}$  to 2 in head and trunk; eye 3 in head, measured from tip of upper jaw; interorbital space 2 to  $2\frac{1}{2}$ ; total length of 7 fish  $1\frac{5}{8}$  to  $3\frac{1}{8}$  inches. Pebas, eastern Peru, and the Ambyiacu River. John Hauxwell.

## CHARACINÆ.

*Asiphonichthys sternopterus* Cope.

Amer. Nat., XXVIII, 1894, p. 67. Type, No. 21,559, A. N. S. P. Upper waters of the Jacuhy River, in the Brazilian State of Rio Grande do Sul. H. H. Smith.—Cope, Proc. Amer. Philos. Soc. Phila., XXXIII, 1894 (January 5), p. 85, Pl. 5, fig. 2. Type.

Width of head  $2\frac{1}{4}$  in its length; interorbital space  $3\frac{1}{4}$ . Body strongly compressed, edges rather rounded. Postdorsal region a little broad and preventral quite so. Postventral region well compressed. Head well compressed. Snout broader than long, and surface convex. Mouth broad. Mandible with rami not elevated inside of mouth. Teeth in jaws small, irregularly biserial in upper, and with several short canines. Mandibular teeth in front of jaw a little enlarged and with at least 4 more or less developed canines. Maxillary with a series of fine teeth along most of its edge. Interorbital space a little

broad and convex. Gill-opening forward about opposite front rim of pupil. Rakers II, 4 + 6, II, rather thick and a trifle more than orbit. Filaments  $\frac{3}{4}$  of orbit. Scales not striated. Color in alcohol brownish with more or less silvery reflections. A narrow pale or grayish streak from shoulder to base of caudal. A grayish blotch size of pupil at shoulder, and a brownish tint at base of caudal medianly. Fins all plain pale brownish. Iris brassy-brown. Length  $3\frac{1}{4}$  inches (caudal damaged).

This example shows the anal rather more enlarged anteriorly than Cope's figure, and also the scales more evenly enlarged in the costal region.

*Charax gibbosus* (Linnaeus).

Head  $3\frac{1}{2}$ ; depth  $2\frac{1}{10}$ ; D. II, 9; A. II, 51; snout  $3\frac{1}{2}$  in head, measured from tip of upper jaw; eye  $3\frac{1}{2}$ ; maxillary  $1\frac{1}{2}$ ; interorbital space  $3\frac{1}{2}$ ; least depth of caudal peduncle  $3\frac{1}{2}$ . Surinam. Dr. Charles Hering. A single small example in poor preservation about 3 inches long.

The genus *Charax* Scopoli as here understood has *Salmo gibbosus* Linnaeus as its type.

*Charax tectifer* (Cope).

*Anacyrtus tectifer* Cope, Proc. Amer. Philos. Soc. Phila., XI, 1869-70 (August 19, 1870), p. 565. Type, No. 8,175, A. N. S. P. Pebas, Equador. John Hauxwell.

*Anacyrtus sanguineus* Cope, Proc. Acad. Nat. Sci. Phila., 1871 (1872), p. 266, Pl. 9, fig. 1. Cotypes, Nos. 8,176 (type) to 8,186, A. N. S. P. Ambyiacu River. John Hauxwell.—Cope, Proc. Amer. Philos. Soc. Phila., XVII, 1877-78 (May 17, 1878), p. 686. Peruvian Amazon. Prof. J. Orton.

Head  $3\frac{1}{2}$ ; depth 3; D. II, 9; A. III, 42, this fin damaged posteriorly, a fact overlooked apparently by Cope, which would thus account for "A. 37"; P. I, 12?; V. I, 7; scales about 46? (squamation injured) in course of lateral line to base of caudal; there are also probably 12? scales between lateral line and origin of anal, instead of 10 as noted by Cope; width of head  $2\frac{3}{8}$  in its length; depth of head, over middle of orbit, about  $1\frac{1}{2}$ ; snout 4; eye  $3\frac{1}{2}$ ; maxillary  $1\frac{1}{2}$ ; interorbital space  $3\frac{1}{2}$ ; mandible  $1\frac{1}{2}$ ; least depth of caudal peduncle  $3\frac{1}{2}$ . The other characters do not appear to me to differ from those of *Anacyrtus sanguineus* Cope. The palatine teeth(?) are obsolete, due possibly to preservation. Coloration, as described by Cope, also agrees with *A. sanguineus*. Further, it may be stated that the anterior free margins of the nasal bones are not more prolonged than in *A. sanguineus*, and overhang the nostrils in a similar manner. Type of *Anacyrtus tectifer* Cope.

The cotypes of *Anacyrtus sanguineus* Cope show: Head  $3\frac{1}{4}$  to  $3\frac{3}{8}$ ; depth  $2\frac{3}{4}$  to 3; D. II, 9; A. IV, 39, I to IV, 41, I; scales 46 to 52 in lateral

line to base of caudal with apparently several more on latter; 12 scales obliquely back from origin of dorsal to lateral line; 12 scales between lateral line and origin of anal; snout  $3\frac{1}{2}$  to 4 in head; eye 3 to  $4\frac{1}{2}$ ; maxillary  $1\frac{1}{2}$  to  $1\frac{3}{4}$ ; interorbital space  $3\frac{3}{4}$  to 4; pectoral  $1\frac{1}{2}$  to  $1\frac{3}{4}$ ; ventral  $1\frac{1}{2}$  to  $1\frac{3}{4}$ ; total length of body  $1\frac{1}{8}$  to  $4\frac{1}{8}$  inches.

Young examples differ somewhat from the adult. The scales on the back are much smaller and crowded in appearance. The origin of the anal begins but a trifle behind that of the dorsal in the vertical, and the anterior portion of the fin is deep. Ventral reaches well beyond origin of anal. The maxillary falls a little short of the posterior orbital margin.

Cope's figure is evidently a little faulty in that the origin of the anal is opposite that of the dorsal, and the spine on the shoulder-girdle in front of the base of the pectoral is omitted.

#### CYRTOCHARAX gen. nov.

Type *Anacyrtus limasquamis* Cope.

Scales rough, very small or about 100 or more in lateral line. No palatine teeth.

Related to *Charax* Scopoli.

(*Aquid*, crooked; *χαραξ*, *Charax*; with reference to the form of the body.)

*Cyrtosoma limasquamis* (Cope). Fig. 44.

*Anacyrtus limasquamis* Cope, Proc. Amer. Philos. Soc. Phila., XVII, 1877-78 (May 17, 1878), p. 686. Cotypes, Nos. 21,460 (type) and 21,461, A. N. of P. Peruvian Amazon. Prof. J. Orton.

Width of head  $2\frac{1}{2}$  in its length; interorbital space 3. Body ~~slightly compressed~~, edges rounded and breast broad. Head ~~convex~~, snout broadly convex. Teeth in upper jaw and front ~~teeth~~ mostly enlarged, those of former biserial with inner ~~teeth~~. Maxillary teeth and those on mandible laterally minute and ~~rounded~~ or numerous. No palatine teeth. Interorbital space ~~convex~~. Gill-opening forward nearly opposite anterior margin of ~~orbit~~. ~~Snout~~ IV, 2 + 7, lanceolate, robust and almost equal orbit. ~~Snout~~ about  $\frac{1}{2}$  of orbit. Tubes of lateral line simple. Vent close ~~to base of anal~~. Color in alcohol brownish, greenish evidently copper ~~shade~~ & dorsal ~~lateral~~ shade from gill-opening above to caudal. ~~Side of head~~ without markings. Iris brownish. Length  $8\frac{1}{2}$  ~~in~~ (including ~~caudal~~). Type.

~~in~~ ~~lateral~~ shows: Head  $3\frac{1}{2}$ ; depth  $2\frac{1}{2}$ ; D. II, 9; A. IV, 39, ~~in~~ lateral line to base of caudal, and about 5 more

on latter; snout  $2\frac{1}{4}$  in head; eye  $4\frac{1}{4}$ ; maxillary  $1\frac{1}{2}$ ; interorbital space  $2\frac{9}{10}$ ; pectoral  $1\frac{3}{8}$ ; ventral  $1\frac{1}{4}$ ; least depth of caudal peduncle  $3\frac{1}{4}$ .

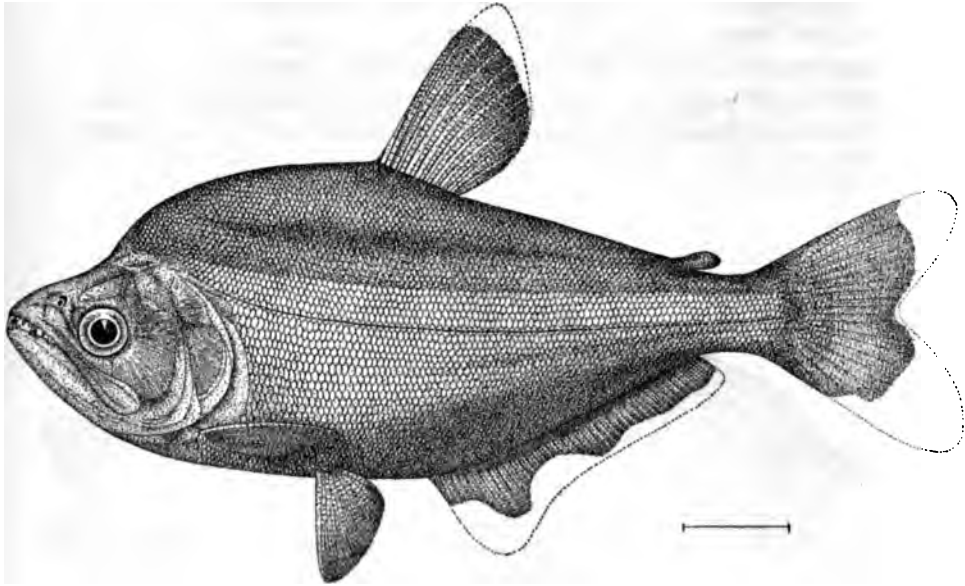


Fig. 44.—*Cyrtcharax limasquamis* (Cope).

In this specimen the pectoral reaches first third of length of ventral, which latter reaches anal, and the humeral and caudal blotches are more distinct. Length  $5\frac{1}{2}$  inches (caudal damaged).

Subgenus *RÆBOIDES* Günther.

*Ræboides myersi* (Gill). Fig. 45.

*Ræboides myersi* Cope, Proc. Acad. Nat. Sci. Phila., 1871 (1872), p. 265. Ambyiacu River. John Hauxwell.—Cope, Proc. Amer. Philos. Soc. Phila., XVII, 1877-78 (May 17, 1878), p. 686. Peruvian Amazon. Prof. J. Orton.

Width of head  $2\frac{1}{10}$  in its length; interorbital space  $3\frac{1}{2}$ . Body deeply compressed, and edges of back and caudal peduncle rounded. Pre-ventral region rather broadly flattened. Postventral region with a median low keel. Head well compressed. Snout much broader than long, and surface convex. Each jaw with 4 external short conic denticles, outer pair of upper on each side with 1 or 2 smaller denticles between. Teeth of upper jaw short, subequal, conic and more or less irregularly biserial, with inner series widely separated. Teeth of mandible small, canines 4, and median pair close together at sym-

physis. Greater portion of maxillary basally with a jagged denticulate edge. Tongue fleshy, triangular and little free in front. Interorbital space convex. Gill-opening forward opposite anterior margin of eye. Rakers  $9 + 15$ , lanceolate, a little longer than filaments or  $\frac{1}{2}$  of eye. Scales striate. Tubes of lateral line simple. Vent close in front of anal. Color in alcohol olivaceous-brown, greenish tint probably due to copper in preservative, and back a little darker. Fins all brownish, bases of pectoral, ventral and caudal with a little dusky

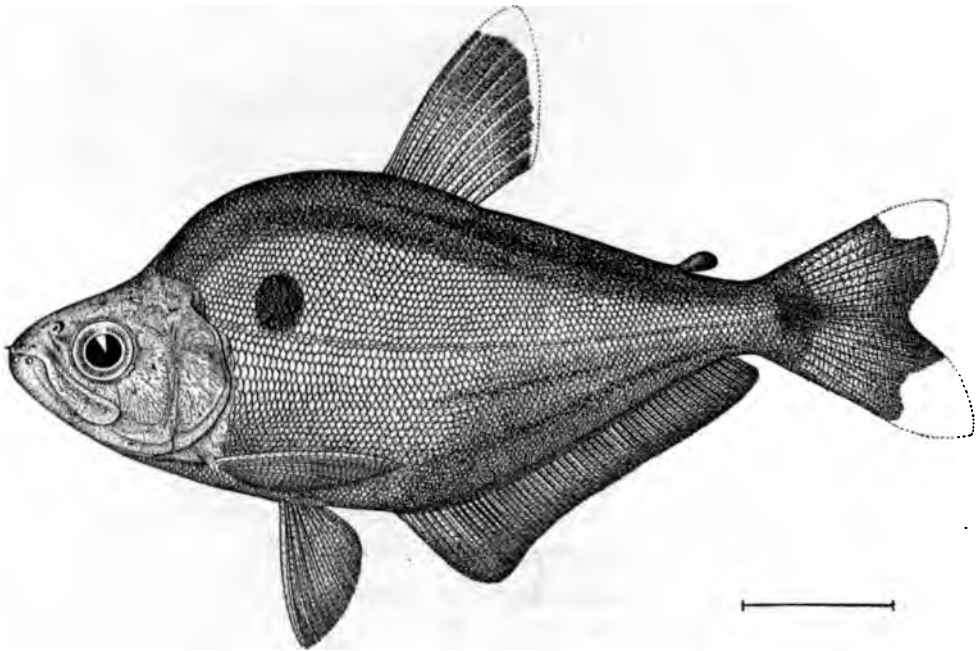


Fig. 45.—*Ræboides myersi* (Gill).

tint. A dusky humeral blotch above lateral line about size of orbit, and also one of same shade on base of caudal, though both rather indistinct. Iris dusky-reddish. Length  $6\frac{3}{8}$  inches (caudal damaged). Three from the Peruvian Amazon.

The 3 examples from the Ambyiacu show: Head  $3\frac{1}{2}$  to  $3\frac{3}{4}$ ; depth  $2\frac{1}{2}$  to  $2\frac{3}{4}$ ; D. II, 9, rarely II, 8; A. IV, 47, 1 to 52, 1, frequently 49, 1; scales about 84 to 86 in lateral line to base of caudal; snout  $3\frac{1}{2}$  to 4 in head; eye  $3\frac{1}{10}$  to  $3\frac{1}{4}$ ; maxillary  $1\frac{1}{4}$  to  $1\frac{1}{2}$ ; interorbital  $3\frac{1}{2}$  to  $3\frac{3}{4}$ ; pectoral  $1\frac{1}{2}$  to  $1\frac{3}{4}$ ; ventral  $1\frac{1}{2}$  to  $1\frac{3}{4}$ ; total length of body (caudals mostly damaged)  $3\frac{1}{2}$  to  $6\frac{1}{2}$  inches.



## CYNOCHARAX subgen. nov.

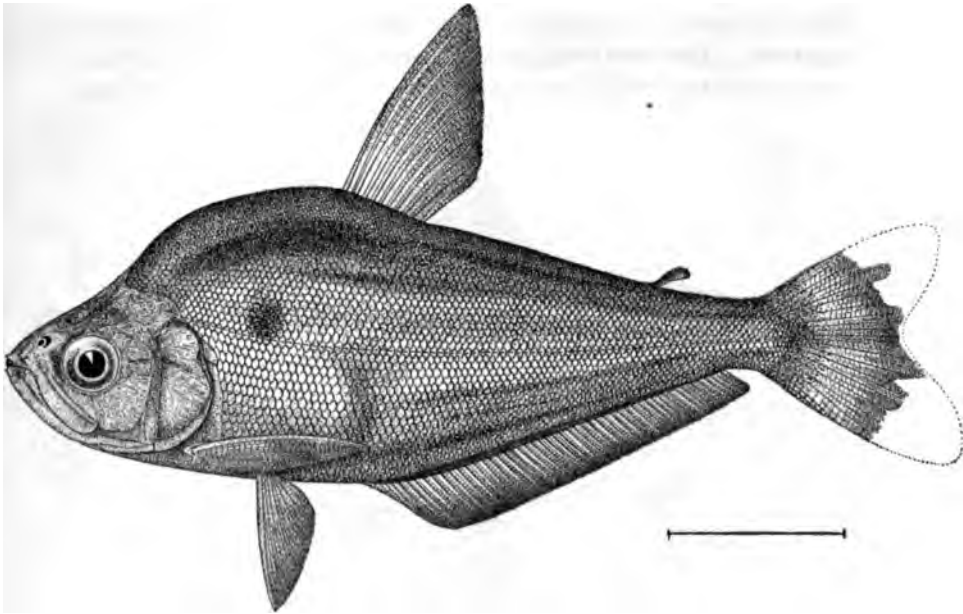
Type *Anacyrtus affinis* Günther.

For those species with well-developed canines in the upper jaw.  
(Κύων, dog; χαραξ, Charax.)

*Ræboides affinis* (Günther). Fig. 46.

*Ræboides rubrivertex* Cope, Proc. Acad. Nat. Sci. Phila., 1871 (1872), p. 265.  
Type, No. 8,190, A. N. S. P. Between the mouth of the Peruvian Amazon or Ucayale river. Robert Perkins.—Cope, *l.c.*, p. 292.

Width of head 2 in its length; interorbital space 3. Body compressed strongly and edges of back rounded. Preventral region rather broad and flattened. Postventral region with a slight median keel or somewhat trenchant. Head well compressed. Snout broadly convex,

Fig. 46.—*Ræboides affinis* (Günther).

much broader than deep. Upper jaw with 6 external teeth, and 1 on outside near base of each maxillary. Mandible with 4 external teeth. Upper jaw with 2 series of teeth of about equal size, posterior not confluent anteriorly. Mandibular teeth uniserial, with 4 canines, pair at symphysis close together. Maxillary with upper  $\frac{3}{4}$  of its edge finely denticulated. No palatine teeth. Tongue fleshy, triangular and free. Interorbital space convex. Gill-opening forward about

opposite posterior nostril. Rakers 10 + 14, lanceolate, and longest about  $\frac{3}{4}$  of orbit or about equal to longest filaments. Scales all more or less striate. Tubes in lateral line simple. Color in alcohol brown, lower surface little paler, and body everywhere more or less silvered. Fins all pale brown, without markings, and a brownish blotch on anterior anal rays. An indistinct or grayish blotch above and on lateral line, well behind shoulder, about size of orbit, and another at base of caudal. A brassy shade from gill-opening above broadly back over side. Iris reddish-brown, pale below. Length  $5\frac{1}{4}$  inches (caudal damaged). Type of *Ræboides rubrivertex* Cope.

*Ræboides bicornis* Cope. Fig. 47.

Proc. Amer. Philos. Soc. Phila., XI, 1869-70 (August 19, 1870), p. 564, fig. (teeth). Type, No. 8,151, A. N. S. P. Pebas, Eastern Equador. John Hauxwell.

Width of head  $3\frac{3}{4}$  in its length; interorbital space  $3\frac{1}{4}$ . Body strongly compressed. Head well compressed. Snout about as broad as long. External denticles well developed, 2 median large and directed for-

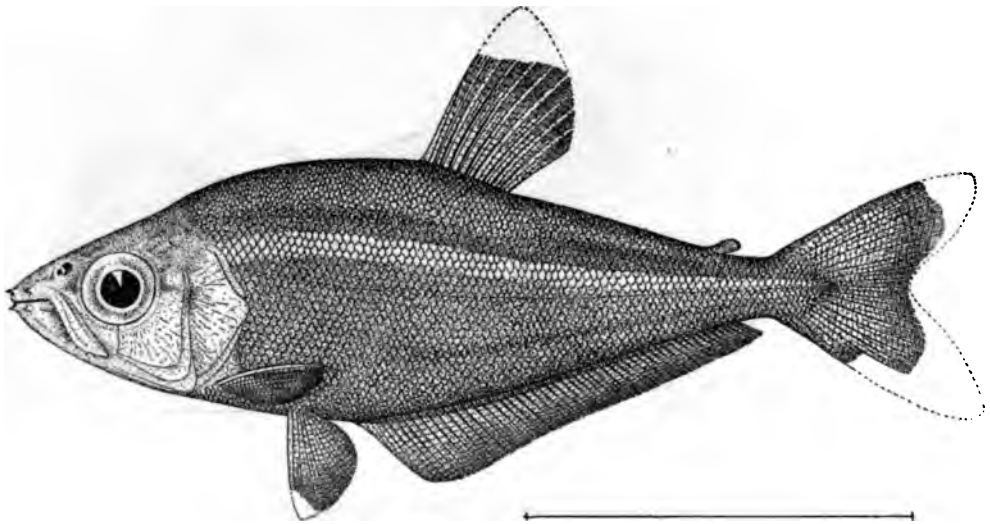


Fig. 47.—*Ræboides bicornis* Cope.

wards, 2 lateral subequal on upper jaw, and 4 mandibulars equally placed. On each side of upper jaw a well-developed canine, and 2 series of smaller similar teeth between or in front, other teeth all smaller and uniserial. Small teeth in mandible with 4 canines, anteriorly median pair close or at symphysis. Maxillary with a number of large denticles of rather irregular size. Tongue long, slender and

little free. Interorbital space convex, and moderately broad. Gill-opening forward to front rim of orbit. Rakers 6 + 9, slender, pointed, a little shorter than longest filaments which are nearly as long as orbit. Tubes in lateral line simple. Color in alcohol faded brownish, lower surface paler, and everywhere with more or less silvered reflections. Fins pale or nearly uniform brownish. Length  $2\frac{1}{2}$  inches (caudal damaged). Type.

*Cynopotamus gulo* Cope. Fig. 48.

Proc. Amer. Philos. Soc. Phila., XI, 1869-70 (August 19, 1870), p. 565.  
Cotypes, Nos. 8,053 (type) to 8,055, A. N. S. P. Pebas, Eastern Peru.  
John Hauxwell.

Width of head  $3\frac{1}{2}$  in its length; interorbital space 4. Body strongly compressed. Head strongly compressed. Snout long as broad. Teeth in upper jaw uniserial, 4 enlarged canines, and several a little smaller laterally as median pair of former are close together. About 10 canines in mandible, 5 on each side anteriorly, and subequally large.

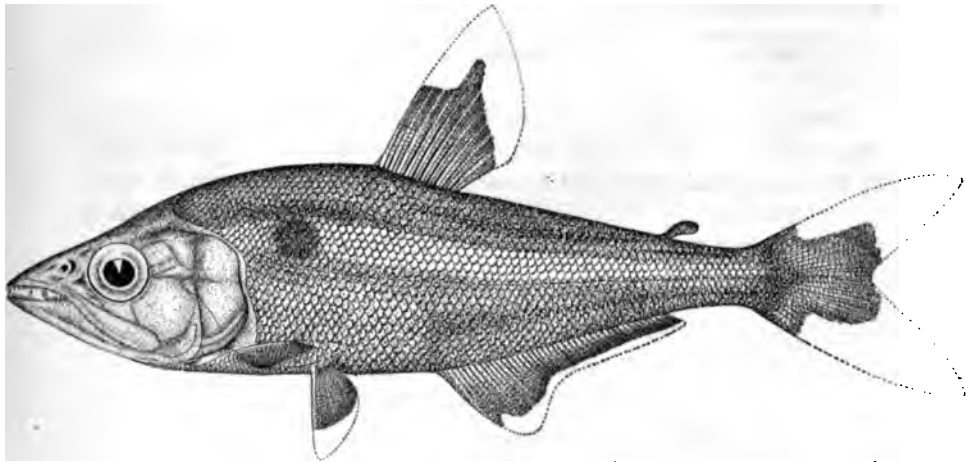


Fig. 48.—*Cynopotamus gulo* Cope.

Other teeth all small like those on maxillary, though forming 2 series anteriorly. Tongue small, fleshy, rounded in front and little free. Interorbital space broad and little convex. Gill-opening forward about front margin of pupil. Rakers iv, 2 + 7, ii, lanceolate, and much longer than filaments or  $\frac{3}{4}$  of orbit. Lateral line of simple tubes. Color in alcohol brownish. A more or less narrow leaden streak from shoulder to base of caudal, with a slightly dusky blotch at humeral region and one at base of caudal. Abdomen showing through pale

brownish. Head more or less silvered. Fins uniform dark brownish. Iris dark brownish. Length  $3\frac{5}{16}$  inches (caudal damaged). Type.

Two larger examples in good preservation show: Head  $3\frac{3}{8}$  and  $3\frac{1}{4}$ ; depth  $3\frac{1}{8}$  and 3; D. II, 9; A. V, 41, I and V, 39, I; P. I, 15 and I, 14; V. II, 7; scales about 76 or 77 in lateral line to base of caudal, and about 5 or 6 more on latter; about 16 scales obliquely back from origin of dorsal to lateral line; about 20 scales between origin of anal and lateral line; about 46 or 47 scales before dorsal; 8 scales obliquely back from origin of adipose dorsal; width of head  $2\frac{3}{8}$  and  $2\frac{1}{10}$  in its length; depth of head  $1\frac{1}{4}$  and  $1\frac{3}{8}$  over posterior margin of orbit; snout 3; eye  $4\frac{1}{2}$  and  $4\frac{3}{8}$ ; maxillary  $1\frac{1}{4}$  and  $1\frac{1}{8}$ ; mandible  $1\frac{1}{4}$  and  $1\frac{1}{8}$ ; interorbital space 3; base of dorsal  $2\frac{3}{8}$  and  $2\frac{1}{4}$ ; least depth of caudal peduncle  $3\frac{3}{8}$  and  $3\frac{5}{8}$ ; total length of specimens (caudal damaged)  $6\frac{7}{8}$  and  $7\frac{1}{8}$  inches respectively. Pebas, Peru. John Hauxwell.

This species will fall within my subgenus *Eucynopotamus*, with the scales a little large, about 75 in the lateral line.

***Aeostorhamphus hepsetus* (Cuvier).**

*Xiporhamphus hepsetus* Cope, Proc. Amer. Philos. Soc. Phila., XXXIII, 1894 (January 5), p. 85. Brazilian province of Rio Grande do Sul. H. H. Smith.

Head  $3\frac{1}{4}$ ; depth  $3\frac{3}{8}$  to  $3\frac{3}{4}$ ; D. II, 9; A. V, 24, I to V, 26, I; scales about 76 in lateral line to base of caudal and several more on latter; snout  $2\frac{5}{8}$  to  $3\frac{1}{10}$  in head; eye  $4\frac{1}{2}$  to  $5\frac{1}{4}$ ; maxillary  $1\frac{3}{8}$  to  $1\frac{1}{4}$ ; interorbital space 5; pectoral  $1\frac{1}{4}$  to  $1\frac{1}{2}$ ; ventral  $1\frac{1}{8}$  to 2; least depth of caudal peduncle  $3\frac{1}{8}$  to 4; gill-rakers V or VI, 2 or 3 + 8 or 9, and II to IV. Two examples.

**SPHYRÆNOCHARAX subgen. nov.**

Type *Xiporhamphus abbreviatus* Cope.

Body rather deep,  $3\frac{1}{4}$  to 4.

(*Σφύραινα*, Sphyræna; *χαράξ*, Charax.)

***Aeostorhynchus brachycephalus* (Cope).**

*Xiporhamphus brachycephalus* Cope, Proc. Amer. Philos. Soc. Phila., XXXIII, 1894 (January 5), p. 84, Pl. 4, fig. 1. Cotypes, Nos. 21,728 (type) and 21,917, A. N. S. P. Brazilian province of Rio Grande do Sul. H. H. Smith.

Width of head 2 in its length; interorbital space 4. Body compressed and edges all more or less rounded. Head compressed. Snout convex and a little broader than long. Teeth on palatines uniserial, little smaller than those along maxillary and side of mandible where compressed. Canines 4 in front of each jaw, at symphysis, not close. Tongue triangularly pointed and free. Interorbital space a little convex. Gill-opening forward opposite posterior nostril. Rakers

iv, 6 + 11, iv, pointed, longest  $\frac{3}{4}$  of filaments which are  $\frac{3}{4}$  of orbit. Each scale with several fine striae. Color in alcohol brownish, sides brassy or silvered. Back a little darker than other portions. Fins all brownish, dorsal and caudal a little darker. A large blackish blotch, a little larger than iris, at base of caudal and extending out on middle caudal rays. An indistinct grayish humeral blotch. Iris brownish, a little darker above. Length  $6\frac{3}{4}$  inches (caudal damaged). Type.

Other example shows: Head  $3\frac{1}{2}$ ; depth  $3\frac{1}{2}$ ; D. ii, 9; A. iv, 25, 1; scales about 55 in lateral line to base of caudal, and 4 more on latter; snout  $3\frac{1}{2}$ ; eye 4; maxillary  $1\frac{1}{2}$ ; interorbital space  $4\frac{1}{2}$ .

*Acestrorhynchus abbreviatus* (Cope). Fig. 49.

*Xiphothamphus abbreviatus* Cope, Proc. Amer. Philos. Soc. Phila., XVII, 1877-78 (May 17, 1878), p. 687. Cotypes, Nos. 21,532 (type), 21,105 to 21,107, and 21,982 and 21,983, A. N. S. P. Peruvian Amazon. Prof. J. Orton.

Width of head  $2\frac{1}{2}$  in its length; interorbital space  $3\frac{1}{2}$ . Body well compressed, and edges of body rounded except thorax, which has a

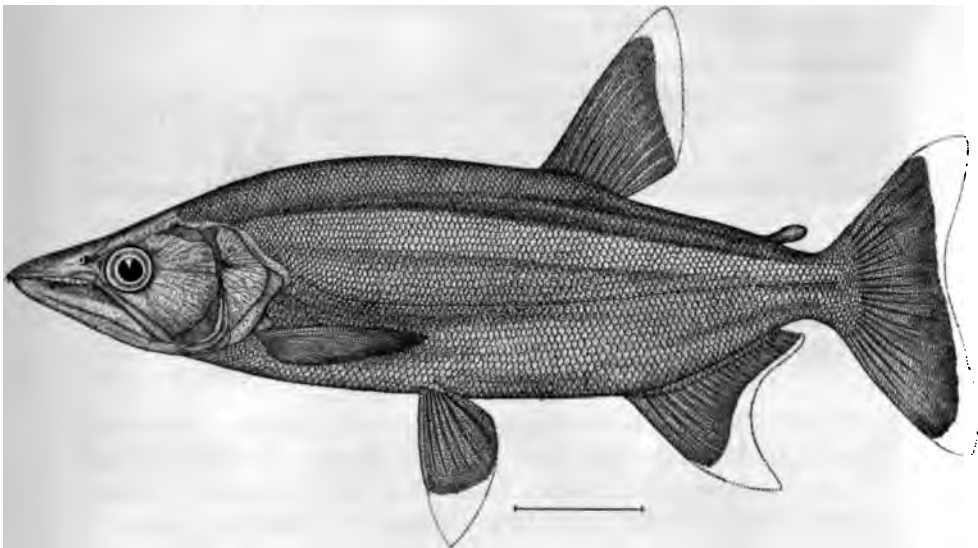


Fig. 49.—*Acestrorhynchus abbreviatus* (Cope).

large median keel. Postdorsal region, and both upper and lower surfaces of caudal peduncle, somewhat flattened and level. Head compressed. Snout a trifle longer than wide. Teeth in jaws rather irregular canines, about 6 well developed in upper and 8 in lower. Other teeth small, those on rami of mandible posteriorly fine, and

similar to those extending whole length of bone. A long series of still finer palatine teeth. Interorbital space broad and a trifle convex. Gill-opening forward opposite anterior nostril. Rakers 8 + 10 rudimentary denticles. Filaments  $\frac{3}{4}$  of orbit. Tubes in lateral line simple. Vent shortly before anal fin. Color in alcohol brownish-brassy, back a little darker than rest of body and with some metallic greenish tints. Fins all pale greenish-brown, each one more or less grayish or pale dusky marginally. Base of caudal with a blackish blotch a little less than orbit. Adipose fin brownish. Iris mostly dark brownish, reddish below. Length  $8\frac{3}{8}$  inches (caudal damaged). Type.

The others show: Head 3 to  $3\frac{1}{2}$ ; depth  $3\frac{1}{2}$  to 4; D. 11, 9; A. v, 20, 1 to v, 24, 1; scales about 80 to 95 in lateral line to base of caudal, and about 5 more on latter; snout 3 in head; eye  $4\frac{1}{2}$  to  $5\frac{1}{2}$ ; maxillary  $1\frac{1}{2}$  to  $1\frac{3}{4}$ ; interorbital space  $3\frac{1}{2}$  to  $3\frac{3}{4}$ ; least depth of caudal peduncle  $4\frac{1}{8}$  to  $4\frac{3}{8}$ ; length of body  $5\frac{1}{4}$  to  $8\frac{1}{4}$  inches.

Subgenus ACESTORHYNCHUS Eigenmann.

Body elongate, depth 6 or 7.

*Acestrorhynchus falcirostris* (Cuvier).

*Xiphorhamphus falcirostris* Cope, Proc. Amer. Philos. Soc. Phila., XVII, 1877-78 (May 17, 1878), p. 688. Peruvian Amazon. Prof. J. Orton.

Head  $3\frac{1}{8}$  to  $3\frac{1}{4}$ ; D. 11, 9; A. v, 21, 1; width of head  $3\frac{3}{8}$  to  $3\frac{3}{4}$  in its length; snout  $2\frac{1}{4}$  to  $2\frac{3}{4}$ ; eye  $4\frac{1}{4}$  to  $5\frac{1}{8}$ ; maxillary  $1\frac{3}{4}$  to  $1\frac{1}{2}$ ; interorbital space  $3\frac{1}{4}$  to 5; least depth of caudal peduncle 5; length (caudals damaged)  $6\frac{1}{2}$  to 11 inches. Two examples from the collections of 1873 and 1877.

*Acestrorhynchus heterolepis* (Cope). Fig. 50.

*Xiphorhamphus heterolepis* Cope, Proc. Amer. Philos. Soc. Phila., XVII, 1877-78 (May 17, 1878), p. 687. Cotypes, Nos. 21,246 (type) to 21,248, A. N. S. P. Peruvian Amazon. Prof. J. Orton.

Width of head  $3\frac{1}{4}$  in its length; interorbital space  $3\frac{1}{2}$ . Body compressed, edges rounded and upper and lower surfaces of caudal peduncle bevelled. Chest with a median keel. Head well compressed. Snout convex above, and its width  $1\frac{1}{2}$  in its length. Teeth along edges of jaws uniserial above, 2 canines at tip in front, midway in length of snout a large canine on each side a little inside, and 3 more between it and front of eye becoming larger as they progress back. In mandible 4 canines at symphysis, all well separated, and second pair largest. Just behind second pair 1 or 2 small teeth, then 3 enlarged canines middle of which is largest, and then follows a single series of small teeth like those along edge of maxillary. A single long series

of small pointed palatine teeth. Tongue conic, elongate and free. Interorbital space a little convex. Gill-opening forward opposite front margin of eye. Rakers absent, edge of first branchial arch trenchant and finely asperous, with about  $21 + 37$  finely asperous laminae externally. Filaments  $\frac{4}{5}$  of eye. Tubes in lateral line at least bifurcate. Color in alcohol brownish, greenish tints evidently due to copper, and with brassy reflections. Fins unmarked, except

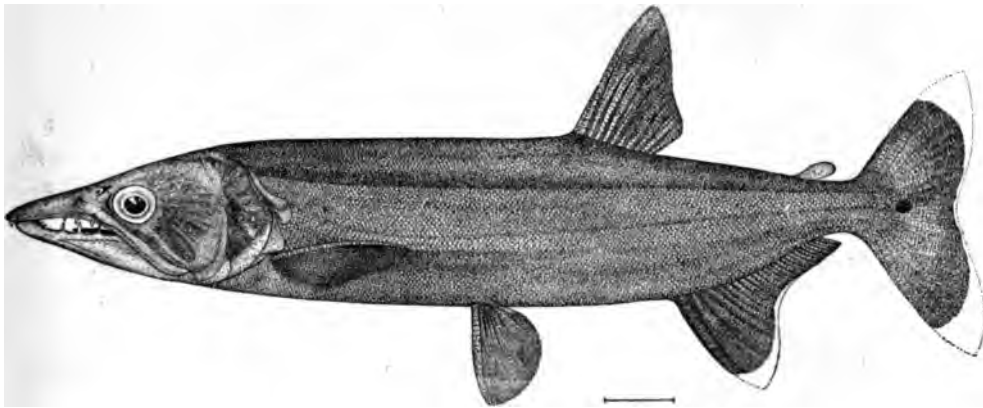


Fig. 50.—*Acestorhynchus heterolepis* (Cope).

base of caudal, which has a black spot medianly about size of pupil. Iris brown. Length  $14\frac{1}{2}$  inches (caudal damaged). Type.

The other examples show: Head  $3\frac{1}{2}$  to  $3\frac{3}{4}$ ; depth 5 to 6; D. II, 9; A. v, 23 or 24, 1; scales about 120 to 130 in lateral line to base of caudal; snout  $1\frac{1}{2}$  to  $2\frac{1}{4}$  in head; eye  $5\frac{1}{2}$  to  $5\frac{3}{4}$ ; interorbital space  $4\frac{1}{2}$  to  $5\frac{1}{4}$ ; least depth of caudal peduncle  $5\frac{1}{2}$  to  $5\frac{3}{4}$ ; length (caudal damaged)  $7\frac{1}{2}$  to  $10\frac{1}{4}$  inches.

***Xiphostoma maculatum* Valenciennes.**

*Xiphostoma tædo* Cope, Proc. Acad. Nat. Sci. Phila., 1871 (1872), p. 267, Pl. 13, fig. 2. Cotypes, Nos. 7,958 (type) and 7,959, A. N. S. P. Ambyiacu River. John Hauxwell.—Cope, Proc. Amer. Philos. Soc. Phila., XVII, 1877-78 (May 17, 1878), p. 688. Peruvian Amazon. Prof. J. Orton

Width of head  $4\frac{1}{2}$  in its length; interorbital space  $5\frac{1}{2}$ . Body well compressed and edges rounded. Head broad and flattened, sides becoming constricted below. Snout depressed above, a little flattened. Teeth in jaws uniform, uniserial and recurved. A rather broad finely asperous tract on each palatine. Tongue triangular and not free. Interorbital space broad and flat. Most osseous areas on head rugosely striate. Gill-opening forward opposite anterior margin of orbit.

Rakers v,  $2 + 7$ , vi, lanceolate, and much shorter than filaments, which are about half of eye. Color in alcohol brownish, color of back well separated from paler color of lower surface, and without markings. Tip of snout brownish. Fins all pale brownish, bases of caudal lobes with pale brownish bars. Faded marks or traces of bars, as indicated by Cope, are evident. Iris brassy. Length  $7\frac{1}{2}$  inches (caudal damaged). Type.

The others show: Head  $2\frac{3}{4}$  to  $2\frac{7}{8}$ ; depth  $6\frac{1}{4}$  to 8; D. II, 8; A. III, 8, 1; scales 77 to 80 in lateral line to base of caudal, and several more on latter; snout  $1\frac{3}{4}$  to  $1\frac{1}{2}$  in head; eye  $8\frac{1}{4}$  to  $9\frac{1}{4}$ ; interorbital space  $4\frac{1}{2}$  to  $5\frac{1}{2}$ ; least depth of caudal peduncle  $4\frac{1}{2}$  to 6; length  $7\frac{1}{8}$  to  $12\frac{3}{8}$  inches (caudal damaged).

**BELONOCHARAX** gen. nov.

Type *Belonocharax beani* sp. nov.

Related to *Boulengerella* Eigenmann, but differing in the larger scales, which are about 50, while in the latter they are about 88. Lateral line incomplete.

(Βελόνη, Belone, the Old World Gar; χαραξ, Charax.)

*Belonocharax beani* sp. nov. Fig. 51.

Head  $2\frac{3}{4}$ ; depth 7; D. II, 8; A. III, 8, 1; P. I, 18; V. I, 7; scales in lateral line, or those with tubes, 27, and count continued to base of caudal 18, also 5 more on latter; 5 scales obliquely forward from origin of dorsal to lateral line; 8 scales obliquely back from origin of adipose fin to lower surface of caudal peduncle; 5 scales obliquely forward from origin of ventral to lateral line; 35 scales before dorsal; width of head  $3\frac{1}{2}$  in its length; depth of head at posterior edge of preopercle  $2\frac{1}{2}$ ; snout  $2\frac{1}{2}$ ; eye  $8\frac{1}{4}$ ; tip of snout to posterior extremity of maxillary  $1\frac{3}{4}$ ; mandible  $1\frac{3}{4}$ ; interorbital space 5; second dorsal ray  $2\frac{1}{2}$ ; third anal ray 3; least depth of caudal peduncle  $4\frac{1}{2}$ ; pectoral  $2\frac{3}{4}$ ; ventral  $3\frac{1}{4}$ .

Body long, rather slender, well compressed, trunk of more or less even depth, and middle of back evidently levelled but without any distinct keels on each side above. Lower edges of body evidently rounded. Postdorsal, postadipose dorsal and postanal edges of body flattened a trifle, and edge on each side a rather obsolete keel. Caudal peduncle well compressed, its length about  $\frac{2}{3}$  its least depth.

Head long, attenuate, or in a long triangle, well compressed, flattened or rather broadened above, and sides becoming constricted somewhat below. Jaws long, tapering, robust, rather depressed, upper project-



ing, flattened towards tip, pyramidal, and mandible rather broader with convex surface or of swollen appearance. Profile of snout a little convex at first, then merging into nearly straight upper profile of head. Profile of mandible at first a little concave, then a little convex. Eye a little posterior in head, high, and a trifle longer than deep. Mouth forming a slight arch. Lips not evident except as a narrow cutaneous fold along margin of mandible. Maxillary narrowly exposed oblique, and extending distal extremity posteriorly till about opposite posterior margin of pupil. Edge of maxillary with fine teeth. Tip of upper jaw a hard or tough point. Teeth in jaws uniserial, rather small, of more or less equal size, compressed or cultrate, crowded one after the other and all directed backwards. When jaws close upper teeth slip over sides of mandibular. In front of upper jaw a  $\Lambda$ -shaped patch of conic teeth progressing in size to outermost, which is

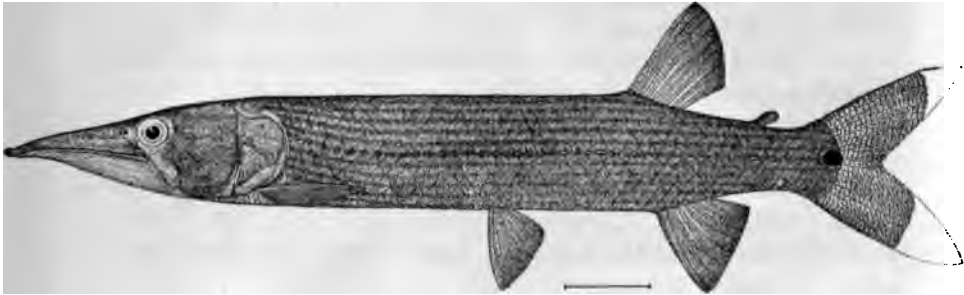


Fig. 51.—*Belonocharax beani* Fowler.

thus canine-like. There are also several other smaller conic teeth still exterior to latter. No teeth at symphysis of mandible. On roof of mouth near front of upper jaw on each side, a short series of several rather irregular small denticles. Buccal membranes broad, reaching first  $\frac{2}{3}$  in length of jaws. Tongue flattened, free, rounded as viewed from above, and its tip falling about last  $\frac{2}{3}$  in length of snout. Bones of head all more or less finely rugose-striate. Opercular flap rather broad.

Gill-opening extending forward about opposite anterior margin of pupil. Gill-rakers about  $8 + 11$  short denticles, longest barely more than half of pupil. Filaments about  $\frac{2}{3}$  of orbit. Isthmus narrow, slender, edge rounded. Bones of shoulder-girdle, where exposed, with slight striæ.

Scales large, of more or less uniform size, each one striate and ctenoid. Scales on breast and bases of caudal and anal smaller than

those on body. Ventral with a small axillary scale. Lateral line, incomplete, midway on side, starting from shoulder, of simple tubes, and ending about 2 scales before origin of dorsal.

Dorsal inserted well posterior or near last  $\frac{3}{4}$  in head and trunk, and second ray evidently highest, others graduated down. Adipose fin placed in last third of space between origin of dorsal and base of caudal, and its length a little less than eye. Anal inserted behind middle of base of dorsal, or nearer base of caudal than that of ventral, and third ray longest, or others graduated down. Caudal forked, lobes pointed. Pectoral reaching less than half way to ventral. Ventral a little more than half way to anal. Vent close in front of anal.

Color in alcohol dull or pale brown, back a deeper shade than lower surface. About 8 longitudinal darker streaks of brownish than general body-color, those below paler. Head brown, lower surface paler. Fins pale brown, dorsal and caudal perhaps a trifle darker. Base of upper caudal lobe with its lower lobe marked with a jet-black blotch a little larger than pupil. Iris pale brownish.

Length about 11 inches (caudal damaged).

Type, No. 16,642, A. N. S. P. Truando, Rio Atrato basin in the Isthmus of Darien, Colombia. From the Smithsonian Institution (No. 1,658).

I am indebted to Mr. Barton A. Bean for the data concerning this fish. According to him it approaches *Xiphostoma hujela* Valenciennes, a species very imperfectly described though, which it seems to resemble so far as the original account permits. Provisionally at least it had best be considered distinct.

(Named for Mr. Barton A. Bean, Assistant Curator of Fishes, United States National Museum.)

**Hydrolycus pectoralis** (Günther).

*Hydrolycus pectoralis* Cope, Proc. Amer. Philos. Soc. Phila., XVII, 1877-78 (May 17, 1878), p. 688. Peruvian Amazon. Prof. J. Orton.

Head 4 to  $4\frac{3}{4}$ ; depth  $3\frac{1}{4}$  to  $3\frac{3}{4}$ ; D. 11, 10; A. 11, 45, 1 usually, sometimes varying to 43 or 46; scales usually 90 in lateral line to base of caudal; snout  $3\frac{1}{2}$  to  $4\frac{1}{4}$  in head, measured from tip of upper jaw; eye, measured vertically,  $2\frac{7}{8}$  to  $3\frac{1}{2}$ ; interorbital space  $3\frac{3}{8}$  to  $4\frac{1}{8}$ ; total length  $5\frac{1}{2}$  to  $8\frac{1}{4}$  inches. Six examples from collections of 1873 and 1877.

**Hydrolycus scomberoides** (Cuvier).

*Hydrolycus scomberoides* Cope, Proc. Acad. Nat. Sci. Phila., 1871 (1872), p. 292. Between the mouth of the Rio Negro and the Peruvian Amazon or Ucayale River. Robert Perkins.

Head  $4\frac{1}{8}$ ; depth 3; D. 11, 10; A. 11, 40, 1; scales about 112 in lateral

line to base of caudal, though pores much fewer; snout 4 in head, measured from tip of upper jaw; eye 4; maxillary  $1\frac{1}{2}$ ; interorbital space 4; least depth of caudal peduncle 3; length  $10\frac{3}{4}$  inches.

**Raphiodon vulpinus** Agassiz.

*Raphiodon vulpinus* Cope, Proc. Amer. Philos. Soc. Phila., XXVII, 1877-78 (May 17, 1878), p. 688. Peruvian Amazon. Prof. J. Orton.

Head  $4\frac{1}{2}$  to 5; depth  $4\frac{1}{2}$  to  $5\frac{1}{2}$ ; D. II, 10; A. IV, 40 to 42, 1; scales about 120 in lateral line to base of caudal, and about 8 more on latter; snout  $3\frac{3}{4}$  to  $3\frac{9}{10}$  in head; eye  $4\frac{1}{4}$  to  $4\frac{1}{2}$ ; maxillary  $1\frac{3}{4}$  to  $1\frac{1}{2}$ ; interorbital space  $5\frac{1}{2}$  to 6; least depth of caudal peduncle  $3\frac{1}{2}$  to  $3\frac{1}{2}$ ; length of body (caudal damaged) 10 to  $12\frac{1}{2}$  inches. Two examples in collections of 1873 and 1877.

**Cynodon gibbus** (Agassiz).

*Raphiodon gibbus* Cope, Proc. Amer. Philos. Soc. Phila., XVII, 1877-78 (May 17, 1878), p. 688. Peruvian Amazon. Prof. J. Orton.

Head  $4\frac{1}{2}$  to  $4\frac{1}{2}$ ; depth  $3\frac{1}{4}$  to  $3\frac{3}{4}$ ; D. II, 10; A. IV, 72, 1 to 11?, 83?, 1; scales 90 to 100 in lateral line to base of caudal; snout  $3\frac{1}{2}$  to 4 in head, measured from tip of upper jaw; eye  $3\frac{1}{2}$  to  $3\frac{3}{4}$ ; maxillary  $1\frac{1}{2}$  to  $1\frac{1}{4}$ ; interorbital space  $3\frac{1}{2}$  to  $3\frac{1}{2}$ ; least depth of caudal peduncle 3 to  $3\frac{1}{2}$ ; length (caudal damaged) 6 to  $6\frac{1}{4}$  inches. Two examples in the collection of 1873.

DISTICHODONTINÆ.

**Distichodus rudolphi** Günther. Fig. 52.

Proc. Zool. Soc. London, 1896 (February 4), p. 223. Cotype, No. 14,559 (type), A. N. S. P. Lake Rudolf, Central Africa. Dr. A. D. Smith.

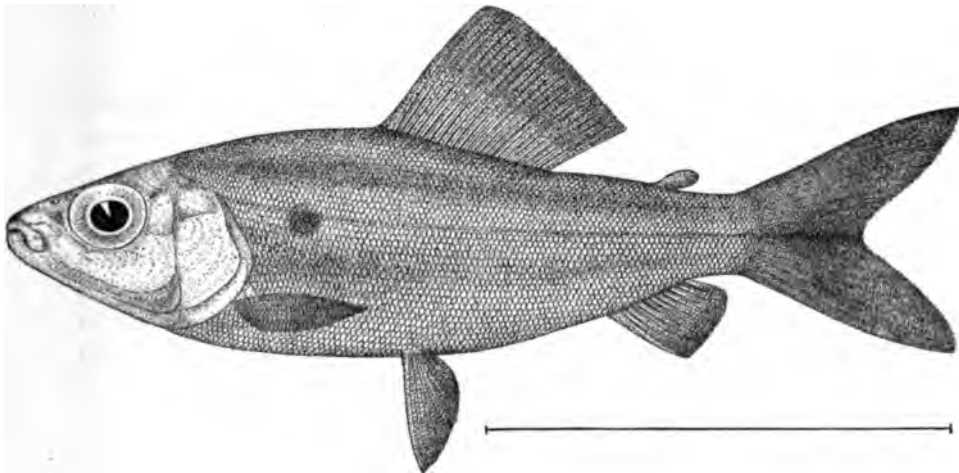


Fig. 52.—*Distichodus rudolphi* Günther.

Width of head  $2\frac{1}{2}$  in its length; interorbital space 4. Body compressed with edges all more or less rounded. Head compressed, convexly round or not especially broad above, and sides becoming constricted below. Snout broader than long and surface convex. Teeth in jaws rather weak, though well developed, compressed, uniserial and bidentate. Tongue free and rounded as seen above. Interorbital space rather broad and slightly convex. Gill-opening forward opposite anterior margin of eye. Rakers reduced as minute tubercles, and filaments a trifle less than orbit. Lateral line with simple tubes. Vent close in front of anal. Color in alcohol brownish, sides and lower surface paler, inclining to whitish and all more or less silvered. Lower surface of head also silvered. A pale or dull slaty humeral blotch about size of pupil. A dull or pale dusky diffuse blotch at base of caudal. Fins all pale brownish, dorsal and caudal a trifle darker, and median rays of latter also pale dusky. Iris pale brassy. Length  $2\frac{1}{2}$  inches (caudal damaged). Type.

#### SERRASALMINÆ.

##### *Pygocentrus piraya* (Cuvier).

*Serrasalmo piraya* Cope, Proc. Amer. Philos. Soc. Phila., XI, 1869-70 (August 19, 1870), p. 566. Para. De Schulte Buckow.

Head  $2\frac{1}{2}$ ; depth  $1\frac{1}{2}$ ; D. I, II, 12; A. III, 29, 1; abdominal serratures 32 to vent; scales about 75 in lateral line to base of caudal and about 8 more on latter; about 33 scales between origin of dorsal and lateral line; about 28 scales between origin of anal and lateral line; about 46 scales before origin of dorsal; about 13 scales obliquely back from origin of adipose fin to lateral line; width of head  $2\frac{1}{2}$  in its length; mandible  $2\frac{2}{3}$ ; pectoral  $1\frac{1}{2}$ ; ventral  $2\frac{1}{2}$ ; least depth of caudal peduncle  $3\frac{2}{3}$ ; snout  $4\frac{1}{2}$  in head, measured from tip of upper jaw; eye  $3\frac{1}{2}$ ; maxillary  $2\frac{1}{2}$ ; interorbital space 3. In alcohol more or less uniform brownish, margins of caudal broadly a little darker brownish. Iris brassy, brownish above and below. Length  $3\frac{1}{2}$  inches.

##### *Pygocentrus nattereri* Kner.

*Serrasalmo nattereri* Cope, Proc. Acad. Nat. Sci. Phila., 1871 (1872), p. 292. Between the mouth of the Rio Negro and the Peruvian Amazon or Ucayale River. Robert Perkins.

Head  $2\frac{1}{2}$  to  $2\frac{3}{4}$ ; depth  $1\frac{3}{4}$  to  $1\frac{1}{2}$ ; D. I, II, 14, 1 to 16, 1; A. I, III, 25, 1 to 28, 1; abdominal serratures 25 to 28; scales 72 to 86 in lateral line to base of caudal and 5 to 10 more continued out on latter; 34 to 38 scales obliquely back from origin of dorsal to lateral line; 30 to 37 scales between origin of anal and lateral line; 15 or 16 scales obliquely back from adipose fin to lateral line; 50 to 54 scales before dorsal; mandible

$2\frac{1}{2}$  to  $2\frac{3}{4}$  in head; pectoral  $1\frac{1}{4}$  to  $1\frac{1}{2}$ ; ventral 3 to  $3\frac{1}{4}$ ; least depth of caudal peduncle  $3\frac{3}{4}$  to  $4\frac{3}{4}$ ; snout 4 to  $4\frac{1}{2}$  in head, measured from tip of upper jaw; eye  $3\frac{1}{4}$  to  $5\frac{1}{4}$ ; maxillary  $2\frac{1}{4}$  to 3; interorbital space  $2\frac{1}{4}$  to  $3\frac{1}{4}$ ; total length of body (with slightly damaged caudal)  $2\frac{3}{4}$  to  $6\frac{1}{4}$  inches. Altogether 5 examples, the largest from between the mouth of the Rio Negro and the Peruvian Amazon or Ucayale river. Of the others 2 belong to Orton's first collection (1873). The remaining 2 examples are small. They are marked with a number of small round brownish spots, each about the size of the pupil, and producing an effect similar to that seen on some examples of *Ephippus argus*. The caudal is margined, within the lobes, and shaded basally with deep brownish. Peruvian Amazon. Prof. J. Orton. Coll. 1877.

***Serrasalmus humeralis* Valenciennes.**

*Serrasalmo humeralis* Cope, Proc. Acad. Nat. Sci. Phila., 1871 (1872), p. 292. Between the mouth of the Rio Negro and the Peruvian Amazon or Ucayale River. Robert Perkins.

Head  $2\frac{1}{2}$ ; depth  $1\frac{5}{8}$  to  $1\frac{3}{4}$ ; D. I, II, 14, I to 15, I; A. I, III, 29, I to 30, I; scales about 75 to 80 in lateral line to base of caudal, and 6 or 7 more on latter; 32 or 33 scales down from origin of dorsal to lateral line; 34 or 35 scales down from lateral line to origin of anal; abdominal scutes 30 to 32; mandible  $2\frac{1}{4}$  to  $2\frac{1}{2}$  in head; pectoral  $1\frac{1}{2}$  to  $1\frac{3}{4}$ ; ventral  $2\frac{3}{4}$  to  $2\frac{1}{2}$ ; least depth of caudal peduncle  $3\frac{1}{4}$  to  $3\frac{3}{4}$ ; snout 4 in head, measured from tip of upper jaw; eye 4 to  $4\frac{1}{4}$ ; maxillary  $2\frac{3}{4}$  to  $2\frac{1}{2}$ ; interorbital space 3 to  $3\frac{1}{4}$ ; total length of body (caudals damaged)  $4\frac{1}{2}$  to  $5\frac{1}{2}$  inches. Two examples.

***Serrasalmus maculatus* (Kner).**

*Serrasalmo maculatus* Cope, Proc. Amer. Philos. Soc. Phila., XI, 1869-70 (August 19, 1870), p. 566. Para. De Schulte Buckow.

Head  $2\frac{3}{4}$ ; depth  $1\frac{1}{2}$ ; D. I, II, 12; A. I, III, 29, I; scales about 77 in lateral line to base of caudal, and 5 more on latter; about 31 scales between origin of dorsal and lateral line; about 32 between origin of anal and lateral line; abdominal scutes 31; mandible  $2\frac{1}{4}$  in head; pectoral  $1\frac{3}{4}$ ; ventral  $2\frac{1}{4}$ ; least depth of caudal peduncle  $3\frac{1}{4}$ ; snout  $4\frac{1}{2}$  in head, measured from tip of upper jaw; eye  $4\frac{1}{4}$ ; maxillary  $2\frac{1}{2}$ ; interorbital space  $3\frac{3}{4}$ ; length of body  $3\frac{3}{4}$  inches (caudal damaged).

***Serrasalmus asopus* (Cope). Fig. 53.**

*Serrasalmo asopus* Cope, Proc. Acad. Nat. Sci. Phila., 1871 (1872), p. 269. Type, No. 7,914, A. N. S. P. From the Marañon, between the mouth of the Rio Negro, Brazil, and the Huallaga, Peru. Robert Perkins.

Width of head  $2\frac{1}{8}$  in its length; interorbital space  $2\frac{3}{4}$  in head, measured from tip of upper jaw. Body strongly compressed. Predorsal region, and postdorsal to adipose fin, with slight median ridge. Chest

~~snout~~ rounded. Edges of caudal peduncle above and below ~~convex~~  
~~snout~~ robust, well compressed. Snout broad with ~~convex~~ ~~snout~~  
~~not~~ ~~teeth~~. Teeth large, triangularly cuneate,  $\frac{5-5}{7-7}$ , and more or less  
~~directed~~ ~~backwards~~. In upper jaw each one with one or more ~~small~~  
~~teeth~~ but of mandibulars only symphyseal one with an ~~apical~~  
~~teeth~~ ~~cusp~~. Mandibular teeth longer than those above, though of  
~~uniform~~ size. Folds of buccal cavity thick and fleshy, more

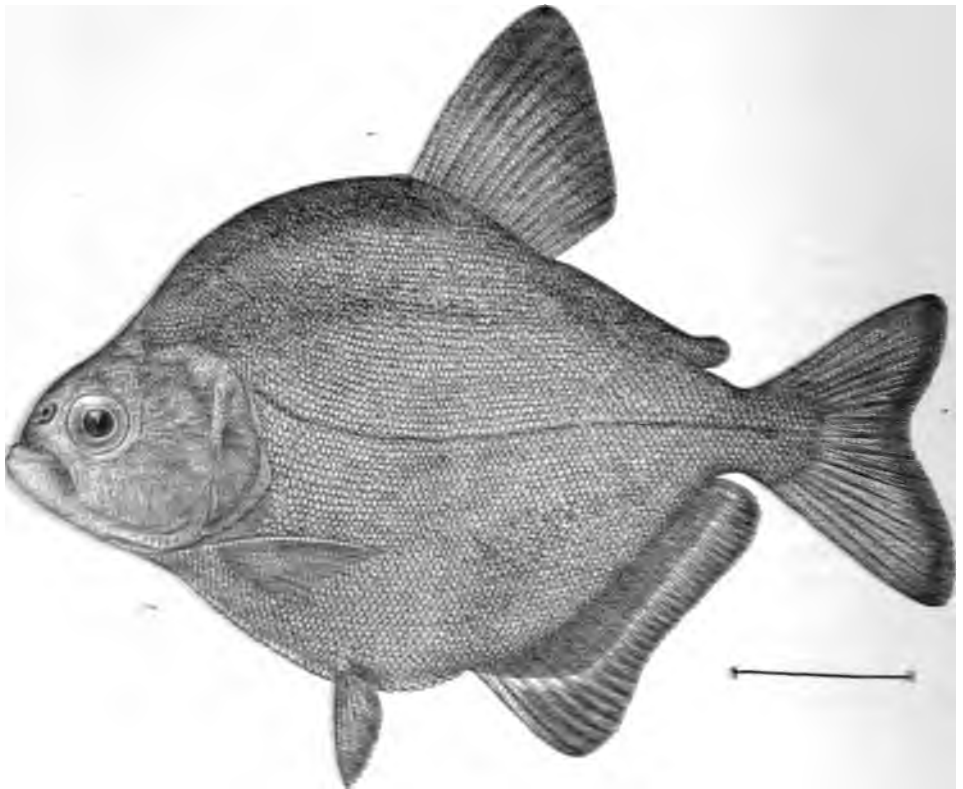


FIG. 55. *Serranobus asotus* (Osteichthys).

or less papillous and with cutaneous fringe corresponding to  
 teeth. Palatine teeth small and uniserial. Tongue with free  
 surface papillous. Interopercular space broad and convex. Gill-open-  
 ing forward to front of opercle. Rictus of 12 more or less  
 rudimentary or absent teeth, central ones a little enlarged.  
 All mouth parts and pharynx which are nearly conical to orbit.  
 Teeth a little different in degrees of number. Very close to front of

anal and not surrounded by abdominal serratures. Color in alcohol faded brownish, back from level with occiput deeper and without brassy tint of lower surface of body. Body also with more or less silvered or brassy reflections. Caudal with a rather broad pale margin, then submarginally rather broadly deep dusky, otherwise pale. Anal with margin rather broadly brownish and base also a little brown. Other fins all more or less pale. Iris yellowish, brownish above. Length  $5\frac{1}{2}$  inches.

**Serrasalmus iridopsis** (Cope).

*Serrasalmo iridopsis* Cope, Proc. Acad. Nat. Sci. Phila., 1871 (1872), p. 268. Pl. 9, fig. 2. Type, No. 7,913, A. N. S. P. Ambyacu River, Ecuador. John Hauxwell.

Width of head  $2\frac{1}{2}$  in its length; interorbital space  $3\frac{1}{2}$ , measured from tip of snout. Body compressed. Head well compressed and robust. Snout convex, and its length  $\frac{2}{3}$  its width. Teeth well developed in jaws, those on mandible  $\frac{5-5}{6-6}$ , large. Each palatine with 7 teeth. Tongue rather narrow, rounded in front and free. Interorbital space broad and convex. Bones of head all more or less radiately striate. Gill-opening forward to middle of eye. Rakers iv + v short denticles, much shorter than filaments, which equal greatest exposed opercular width. Color in alcohol brownish, sides silvered. Back with a number of rounded maculations, ranging in size up to that of pupil, and fading out on flanks. Fins all pale brownish, dorsal and caudal a trifle more deep in shade marginally. Iris pale brassy. Length  $4\frac{1}{2}$  inches (caudal damaged).

Although Cope states that the abdominal serratures are "forty-one," his figure would indicate altogether but 31. Still as the type at present shows 32 serræ, it is possible that some of those on the breast may have fallen.

**Serrasalmus immaculatus** (Cope). Fig. 54.

*Serrasalmo immaculatus* Cope, Proc. Amer. Philos. Soc. Phila., XVII, 1877-78 (May 17, 1878), p. 692. Cotypes, Nos. 21,503 (type) to 21,505, A. N. S. P. Peruvian Amazon. Prof. J. Orton.

Width of head  $2\frac{1}{2}$  in its length; interorbital space  $2\frac{1}{2}$  in head, measured from tip of upper jaw. Body strongly compressed, and predorsal and postdorsal regions, to adipose fin, with a slight median ridge. Upper and lower surfaces of caudal peduncle a little compressed convexly. Head compressed. Snout broad and surface convex. Teeth  $\frac{5-5}{7-7}$ . Palatine teeth 7 on each side. Gill-opening forward opposite middle of orbit. Rakers x + viii rounded scabrous processes and each with a short denticulation. Filaments about equal eye. Color in alcohol brownish, more or less dull and uniform or only with

similar to those extending whole length of bone. A long series of still finer palatine teeth. Interorbital space broad and a trifle convex. Gill-opening forward opposite anterior nostril. Rakers 8 + 10 rudimentary denticles. Filaments  $\frac{3}{4}$  of orbit. Tubes in lateral line simple. Vent shortly before anal fin. Color in alcohol brownish-brassy, back a little darker than rest of body and with some metallic greenish tints. Fins all pale greenish-brown, each one more or less grayish or pale dusky marginally. Base of caudal with a blackish blotch a little less than orbit. Adipose fin brownish. Iris mostly dark brownish, reddish below. Length  $8\frac{3}{8}$  inches (caudal damaged). Type.

The others show: Head 3 to  $3\frac{1}{2}$ ; depth  $3\frac{1}{2}$  to 4; D. II, 9; A. V, 20, 1 to V, 24, 1; scales about 80 to 95 in lateral line to base of caudal, and about 5 more on latter; snout 3 in head; eye  $4\frac{1}{2}$  to  $5\frac{1}{2}$ ; maxillary  $1\frac{1}{2}$  to  $1\frac{3}{4}$ ; interorbital space  $3\frac{1}{2}$  to  $3\frac{3}{4}$ ; least depth of caudal peduncle  $4\frac{1}{8}$  to  $4\frac{1}{2}$ ; length of body  $5\frac{1}{4}$  to  $8\frac{1}{4}$  inches.

Subgenus ACESTRORHYNCHUS Eigenmann.

Body elongate, depth 6 or 7.

*Acestrorhynchus falcirostris* (Cuvier).

*Xiphorhamphus falcirostris* Cope, Proc. Amer. Philos. Soc. Phila., XVII, 1877-78 (May 17, 1878), p. 688. Peruvian Amazon. Prof. J. Orton.

Head  $3\frac{1}{4}$  to  $3\frac{1}{2}$ ; D. II, 9; A. V, 21, 1; width of head  $3\frac{3}{8}$  to  $3\frac{5}{8}$  in its length; snout  $2\frac{1}{4}$  to  $2\frac{3}{4}$ ; eye  $4\frac{1}{4}$  to  $5\frac{1}{8}$ ; maxillary  $1\frac{7}{8}$  to  $1\frac{1}{2}$ ; interorbital space  $3\frac{1}{4}$  to 5; least depth of caudal peduncle 5; length (caudals damaged)  $6\frac{1}{2}$  to 11 inches. Two examples from the collections of 1873 and 1877.

*Acestrorhynchus heterolepis* (Cope). Fig. 50.

*Xiphorhamphus heterolepis* Cope, Proc. Amer. Philos. Soc. Phila., XVII, 1877-78 (May 17, 1878), p. 687. Cotypes, Nos. 21,246 (type) to 21,248, A. N. S. P. Peruvian Amazon. Prof. J. Orton.

Width of head  $3\frac{1}{4}$  in its length; interorbital space  $3\frac{1}{4}$ . Body compressed, edges rounded and upper and lower surfaces of caudal peduncle bevelled. Chest with a median keel. Head well compressed. Snout convex above, and its width  $1\frac{3}{8}$  in its length. Teeth along edges of jaws uniserial above, 2 canines at tip in front, midway in length of snout a large canine on each side a little inside, and 3 more between it and front of eye becoming larger as they progress back. In mandible 4 canines at symphysis, all well separated, and second pair largest. Just behind second pair 1 or 2 small teeth, then 3 enlarged canines middle of which is largest, and then follows a single series of small teeth like those along edge of maxillary. A single long series



of small pointed palatine teeth. Tongue conic, elongate and free. Interorbital space a little convex. Gill-opening forward opposite front margin of eye. Rakers absent, edge of first branchial arch trenchant and finely asperous, with about  $21 + 37$  finely asperous laminae externally. Filaments  $\frac{4}{7}$  of eye. Tubes in lateral line at least bifurcate. Color in alcohol brownish, greenish tints evidently due to copper, and with brassy reflections. Fins unmarked, except

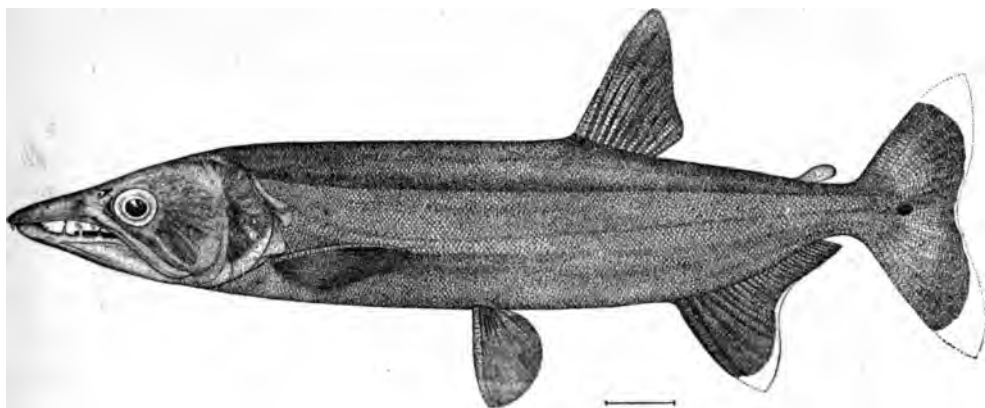


Fig. 50.—*Acestorhynchus heterolepis* (Cope).

base of caudal, which has a black spot medianly about size of pupil. Iris brown. Length  $14\frac{1}{2}$  inches (caudal damaged). Type.

The other examples show: Head  $3\frac{1}{2}$  to  $3\frac{3}{4}$ ; depth 5 to 6; D. II, 9; A. v, 23 or 24, 1; scales about 120 to 130 in lateral line to base of caudal; snout  $1\frac{1}{2}$  to  $2\frac{1}{4}$  in head; eye  $5\frac{1}{2}$  to  $5\frac{3}{4}$ ; interorbital space  $4\frac{1}{2}$  to  $5\frac{1}{2}$ ; least depth of caudal peduncle  $5\frac{1}{2}$  to  $5\frac{3}{4}$ ; length (caudal damaged)  $7\frac{1}{2}$  to  $10\frac{1}{4}$  inches.

***Xiphostoma maculatum* Valenciennes.**

*Xiphostoma tædo* Cope, Proc. Acad. Nat. Sci. Phila., 1871 (1872), p. 267, Pl. 13, fig. 2. Cotypes, Nos. 7,958 (type) and 7,959, A. N. S. P. Ambyiacu River. John Hauxwell.—Cope, Proc. Amer. Philos. Soc. Phila., XVII, 1877-78 (May 17, 1878), p. 688. Peruvian Amazon. Prof. J. Orton

Width of head  $4\frac{1}{2}$  in its length; interorbital space  $5\frac{1}{2}$ . Body well compressed and edges rounded. Head broad and flattened, sides becoming constricted below. Snout depressed above, a little flattened. Teeth in jaws uniform, uniserial and recurved. A rather broad finely asperous tract on each palatine. Tongue triangular and not free. Interorbital space broad and flat. Most osseous areas on head rugosely striate. Gill-opening forward opposite anterior margin of orbit.

Rakers v, 2 + 7, vi, lanceolate, and much shorter than filaments, which are about half of eye. Color in alcohol brownish, color of back well separated from paler color of lower surface, and without markings. Tip of snout brownish. Fins all pale brownish, bases of caudal lobes with pale brownish bars. Faded marks or traces of bars, as indicated by Cope, are evident. Iris brassy. Length  $7\frac{1}{2}$  inches (caudal damaged). Type.

The others show: Head  $2\frac{3}{4}$  to  $2\frac{7}{8}$ ; depth  $6\frac{1}{2}$  to 8; D. II, 8; A. III, 8, I; scales 77 to 80 in lateral line to base of caudal, and several more on latter; snout  $1\frac{3}{4}$  to  $1\frac{1}{2}$  in head; eye  $8\frac{1}{2}$  to  $9\frac{1}{2}$ ; interorbital space  $4\frac{1}{2}$  to  $5\frac{1}{2}$ ; least depth of caudal peduncle  $4\frac{2}{3}$  to 6; length  $7\frac{1}{8}$  to  $12\frac{3}{8}$  inches (caudal damaged).

**BELONCHARAX** gen. nov.

Type *Beloncharax beani* sp. nov.

Related to *Boulengerella* Eigenmann, but differing in the larger scales, which are about 50, while in the latter they are about 88. Lateral line incomplete.

(*Βελόνη*, Belone, the Old World Gar; *χαράξ*, Charax.)

*Beloncharax beani* sp. nov. Fig. 51.

Head  $2\frac{3}{4}$ ; depth 7; D. II, 8; A. III, 8, I; P. I, 18; V. I, 7; scales in lateral line, or those with tubes, 27, and count continued to base of caudal 18, also 5 more on latter; 5 scales obliquely forward from origin of dorsal to lateral line; 8 scales obliquely back from origin of adipose fin to lower surface of caudal peduncle; 5 scales obliquely forward from origin of ventral to lateral line; 35 scales before dorsal; width of head  $3\frac{1}{4}$  in its length; depth of head at posterior edge of preopercle  $2\frac{1}{4}$ ; snout  $2\frac{1}{4}$ ; eye  $8\frac{1}{2}$ ; tip of snout to posterior extremity of maxillary  $1\frac{1}{2}$ ; mandible  $1\frac{1}{2}$ ; interorbital space 5; second dorsal ray  $2\frac{1}{4}$ ; third anal ray 3; least depth of caudal peduncle  $4\frac{1}{2}$ ; pectoral  $2\frac{3}{8}$ ; ventral  $3\frac{1}{4}$ .

Body long, rather slender, well compressed, trunk of more or less even depth, and middle of back evidently levelled but without any distinct keels on each side above. Lower edges of body evidently rounded. Postdorsal, postadipose dorsal and postanal edges of body flattened a trifle, and edge on each side a rather obsolete keel. Caudal peduncle well compressed, its length about  $\frac{2}{3}$  its least depth.

Head long, attenuate, or in a long triangle, well compressed, flattened or rather broadened above, and sides becoming constricted somewhat below. Jaws long, tapering, robust, rather depressed, upper project-

ing, flattened towards tip, pyramidal, and mandible rather broader with convex surface or of swollen appearance. Profile of snout a little convex at first, then merging into nearly straight upper profile of head. Profile of mandible at first a little concave, then a little convex. Eye a little posterior in head, high, and a trifle longer than deep. Mouth forming a slight arch. Lips not evident except as a narrow cutaneous fold along margin of mandible. Maxillary narrowly exposed oblique, and extending distal extremity posteriorly till about opposite posterior margin of pupil. Edge of maxillary with fine teeth. Tip of upper jaw a hard or tough point. Teeth in jaws uniserial, rather small, of more or less equal size, compressed or cultrate, crowded one after the other and all directed backwards. When jaws close upper teeth slip over sides of mandibular. In front of upper jaw a  $\Lambda$ -shaped patch of conic teeth progressing in size to outermost, which is

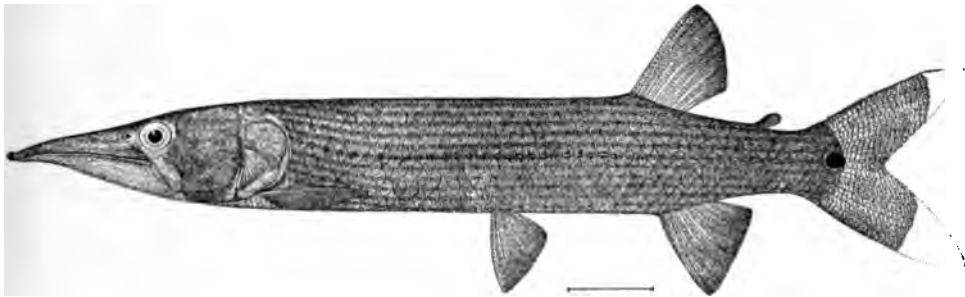


Fig. 51.—*Belonocharax beani* Fowler.

thus canine-like. There are also several other smaller conic teeth still exterior to latter. No teeth at symphysis of mandible. On roof of mouth near front of upper jaw on each side, a short series of several rather irregular small denticles. Buccal membranes broad, reaching first  $\frac{2}{3}$  in length of jaws. Tongue flattened, free, rounded as viewed from above, and its tip falling about last  $\frac{2}{3}$  in length of snout. Bones of head all more or less finely rugose-striate. Opercular flap rather broad.

Gill-opening extending forward about opposite anterior margin of pupil. Gill-rakers about 8 + 11 short denticles, longest barely more than half of pupil. Filaments about  $\frac{2}{3}$  of orbit. Isthmus narrow, slender, edge rounded. Bones of shoulder-girdle, where exposed, with slight striae.

Scales large, of more or less uniform size, each one striate and ctenoid. Scales on breast and bases of caudal and anal smaller than

on surface. Teeth large in mandible, those anteriorly forming transverse series of 4 largest and other 5 on each side of mandible graduated down posteriorly. Anterior mandibular teeth with cutting edges, and each one at symphysis with a large cusp. In upper jaw 5 teeth in each external series approximated with 4 transverse annectant ones, which latter together with last 3 externals, are bicuspid. Tongue thick and not free. Lips a little fleshy. Interorbital space broadly

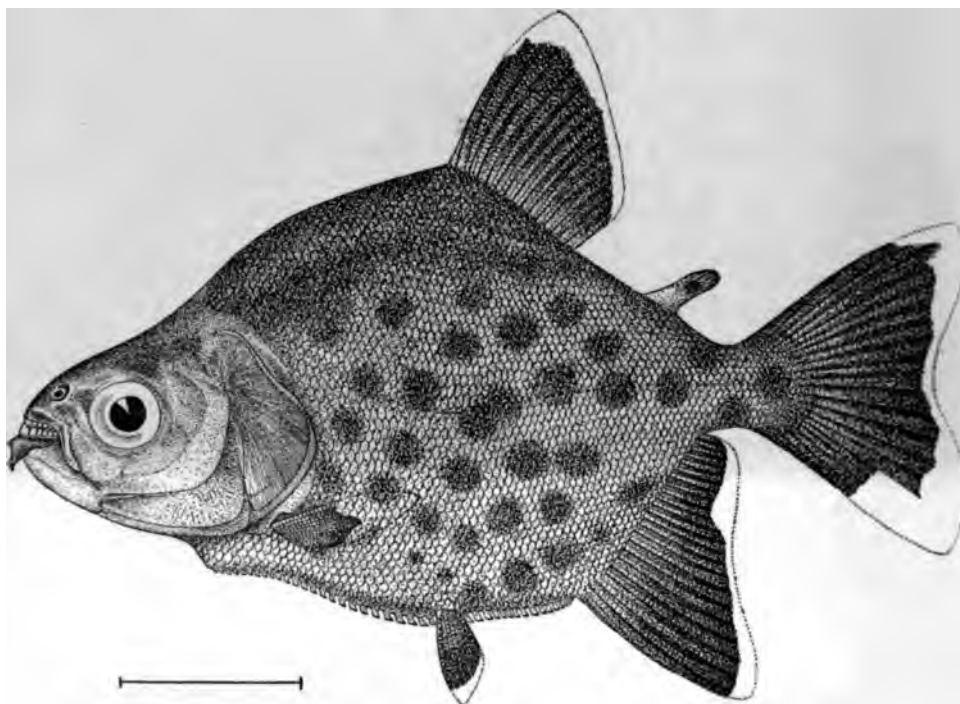


Fig. 55.—*Colossoma nigripinnis* (Cope).

convex. Gill-opening forward to front edge of eye. Rakers  $39 + 39$ , slender, about  $\frac{1}{4}$  of orbit. Filaments equal orbit. Tubes in lateral line simple. Color in alcohol olivaceous-brown, greenish most likely due to preservative, and lower regions but little paler. Trunk with many blackish or dusky blotches as large as or a little larger than pupil, those below smallest. Membrane of fins more or less dusky-brown, dorsal paler, and also bases of caudal, pectoral and ventral pale. Lips dusky or brownish. Iris yellowish. Length  $5\frac{1}{2}$  inches (caudal damaged).

Cope's statement, that "the two posterior mandibulars are in contact with the median pair of the anterior series, and are separated by a narrow interspace from each other," evidently refers to the teeth of the upper jaw.

**REGANINA** gen. nov.

Type *Myletes bidens* Agassiz.

Body rather elongate, not entirely orbicular, or not as deep as long. Abdominal profile moderately convex, not pendant. Abdominal serratures rather numerous, 56. Squamous area on base of anal fin rather low and sharply defined from rest of fin. Adipose fin rather free, not especially enlarged or elongated. No external free short cultrate predorsal spine.

(Named for Dr. C. Tate Regan, of the British Museum of Natural History, author of many excellent contributions to Ichthyology.)

*Reganina bidens* (Agassiz).

*Myletes bidens* Cope, Proc. Acad. Nat. Sci. Phila., 1871 (1872), p. 291. Between the mouth of the Rio Negro and the Peruvian Amazon or Ucayale River. Robert Perkins.—Cope, Proc. Amer. Philos. Soc. Phila., XVII, 1877-78 (May 17, 1878), p. 694. Peruvian Amazon. Prof. J. Orton.

Head 3; depth  $1\frac{3}{4}$ ; D. v, 14; A. III, 23, I; abdominal serratures 51 + 5; scales about 85 in lateral line to base of caudal, and 5 more on latter; 35 scales between origin of dorsal and lateral line; about 40 scales between vent and lateral line, and same number between root of ventral and lateral line; 46 scales before dorsal; snout  $3\frac{3}{4}$  in head, measured from tip of upper jaw; eye  $4\frac{1}{4}$ ; mandible  $2\frac{3}{4}$ ; interorbital space  $2\frac{1}{4}$ ; pectoral  $1\frac{3}{4}$ ; ventral  $1\frac{1}{4}$ ; least depth of caudal peduncle  $2\frac{3}{4}$ . Gill-rakers 19 + 18, I, lanceolate, and about  $\frac{1}{2}$  of longest filaments, which are about equal to orbit. Color in alcohol brownish, belly paler, and fins all more or less brownish, becoming darker marginally. Anal with a longitudinal median brown band, anterior radii of fin pale or whitish. Opercle with a brownish blotch. Iris dull yellowish. Length 9 inches. Between the mouth of the Rio Negro and the Peruvian Amazon. Robert Perkins.

This example agrees largely with Agassiz' figure. However, the scales on the base of the anal fin are not indicated as sharply demarcated from the rest of the same, so that in width this squamous area is but a little broader anteriorly.

*Mylossoma albiscopius* (Cope).

*Myletes albiscopius* Cope, Proc. Acad. Nat. Sci. Phila., 1871 (1872), p. 267, Pl. 12, fig. 1. Cotypes, Nos. 8,014 to 8,021 (type), A. N. S. P. Ambyiacu River. John Hauxwell.—Cope, *l.c.*, p. 292. Between the mouth of the Rio Negro and the Peruvian Amazon. Robert Perkins.

Width of head 2 in its length; interorbital space  $2\frac{1}{4}$  in head, measured

from tip of upper jaw. Body strongly compressed, edges rounded. Head robust. Snout broad and convex. Lips without triangular cutaneous corners, though broad. Upper teeth 5 in each external series, and with a transverse connecting series of 4. Mandibular teeth larger, 8 in number, 4 median greatly enlarged and pair at symphysis each with a large external cusp. All teeth with a cutting edge, and some, like transverse series above, bicuspid. Tongue not free, broad and rounded in front. Interorbital space broad and convex. Gill-opening forward opposite front of eye. Rakers 12 + 18, lanceolate and equal pupil. Filaments a trifle less than orbit. Tubes in lateral line simple. Color in alcohol dull or pale brassy-brown, back a little darker than lower surface and everywhere with more or less brassy reflections. Fins all pale or uniform brownish. Iris dull or pale orange. Length 6 inches. Type.

The others show: Head  $2\frac{3}{4}$  to  $3\frac{1}{2}$ ; depth  $1\frac{1}{2}$  to  $1\frac{1}{4}$ ; D. III, 13, 1 to 16, 1, usually 14, 1 or 15, 1; A. III or IV, 31, 1 to 36, 1; scales 70 to 78 in lateral line to base of caudal, and 3 to 9 more on latter; serratures 41 to 47 + 4 to 8 on abdomen; snout  $3\frac{1}{2}$  to 4 in head; eye  $2\frac{1}{2}$  to  $\bar{4}$ ; interorbital space  $2\frac{1}{2}$  to  $2\frac{3}{4}$ ; pectoral  $1\frac{1}{2}$  to  $1\frac{3}{4}$ ; ventral 2 to  $2\frac{1}{2}$ ; total length of body  $2\frac{1}{2}$  to  $5\frac{1}{2}$  inches, with caudals mostly damaged. The opercular blotch at present is only a little brownish in most cases.

**STARKSINA** gen. nov.

Type *Myletes herniarius* Cope.

Body nearly as deep as long. Profile of belly well rounded convexly and pendant. Abdominal serratures rather few, 41. Posterior series of teeth in upper jaw separated from anterior by an interspace. Anal and caudal more or less covered with small scales passing out from body without special demarcation. Adipose fin small and free. No external free short cultrate predorsal spine.

(Dedicated to Mr. Edwin C. Starks, of the Leland Stanford Junior University, California, well known for his contributions to the osteology of fishes.)

*Starksina herniarius* (Cope). Fig. 56.

*Myletes herniarius* Cope, Proc. Acad. Nat. Sci. Phila., 1871 (1872), p. 268, Pl. 12, fig. 3. Cotypes, Nos. 7,990 and 8,025 (type), A. N. S. P. Ambyiacu River. John Hauxwell.—Cope, Proc. Amer. Philos. Soc. Phila., XVII, 1877-78 (May 17, 1878), p. 693. Peruvian Amazon. Prof. J. Orton.

Width of head  $1\frac{1}{2}$  in its length; interorbital space  $2\frac{1}{2}$  in head, measured from tip of upper jaw. Edges of body more or less trenchant. Head well compressed, becoming a little restricted below. Snout

broad and convex. Lips thin. Teeth in jaws heavy, robust, and all more or less smaller and of subequal size in upper jaw. In latter arranged in an external approximated series of 5 on each side, and each with a cusp at least, those most external with 3. Transversely 4 teeth connecting outer series, and tip of each with as many as 4

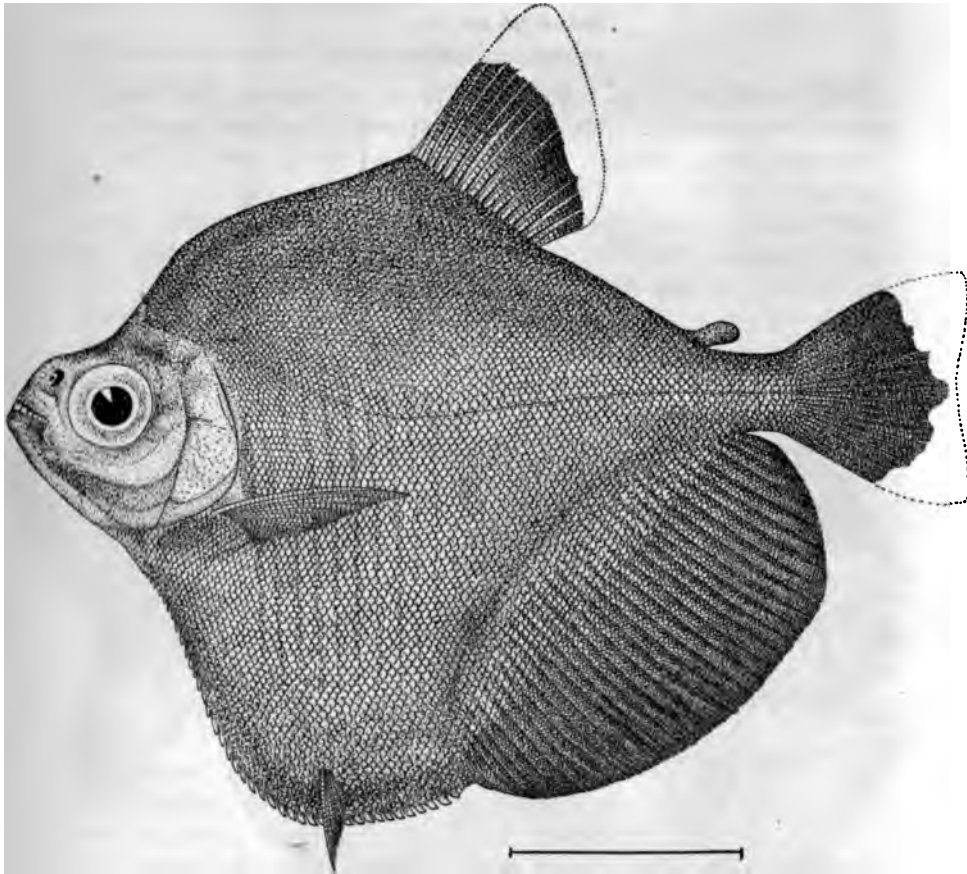


Fig. 56.—*Starksina herniarius* (Cope).

cusps in most cases. Mandibular teeth arranged transversely across front of mandible, 3 on each side, with cutting edges, each with 1 cusp at least and each symphyseal with a large conic internal cusp. External mandibular teeth small and inconspicuous, and posterior dentary edges hard and rather sharp. Tongue a little elongate and not free. Interorbital space broad and convex. Gill-opening for-

ward nearly opposite front rim of eye. Rakers 12 + 12, lanceolate, and longest 3 in eye. Filaments  $1\frac{1}{2}$  in eye. Tubes in lateral line simple. Vent close in front of anal, without serræ. Color in alcohol plain dull brassy-brown, and back more or less dull plumbeous-brown. Fins uniformly colored pale brown. Iris deep brown. Length  $4\frac{1}{2}$  inches (caudal damaged). Cotype.

**SEALEINA** gen. nov.

Type *Myletes lippincottianus* Cope.

Body nearly orbicular. Abdominal profile moderately and evenly convex, not pendant. Abdominal serratures rather few, 42. Pos-

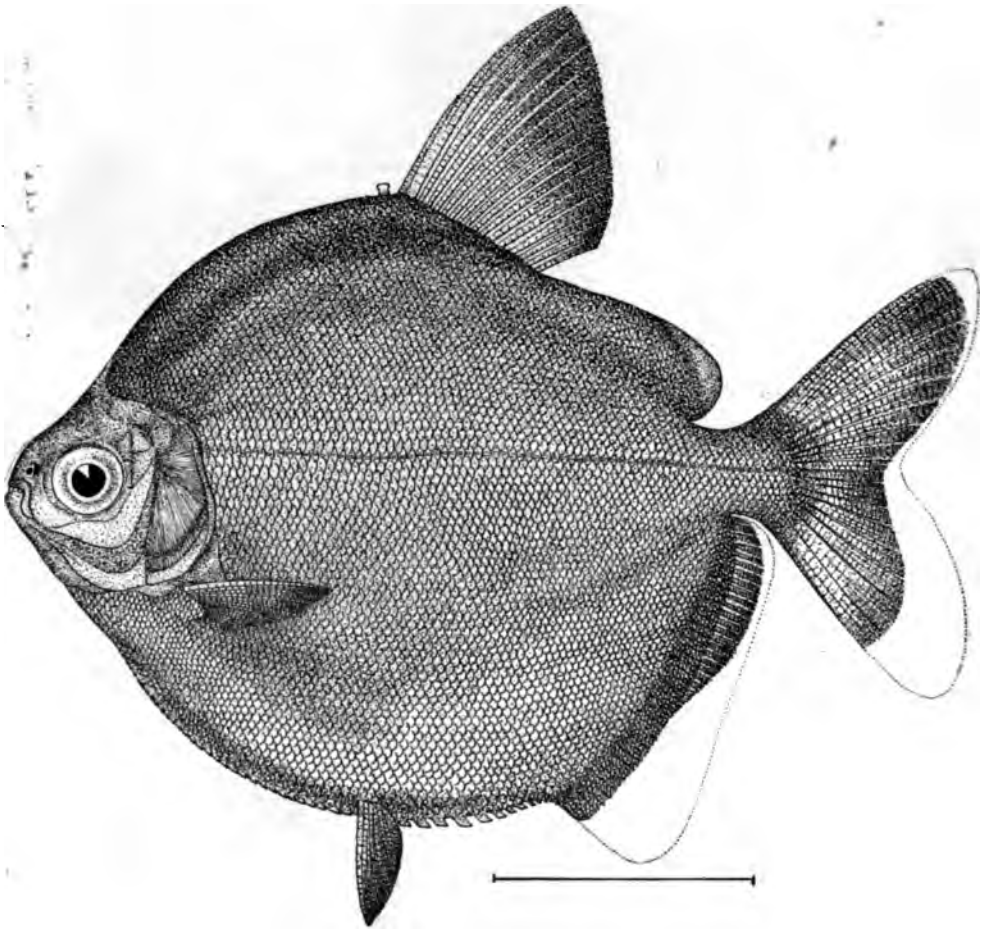


Fig. 57.—*Sealeina lippincottianus* (Cope).



terior series of teeth in upper jaw not separated from anterior by an interspace. Squamous area on base of anal rather low and well defined from marginal part of fin. Adipose fin large, long, not free. A small external short free cultrate predorsal spine.

(Named for Mr. Alvin Seale, formerly of the Bishop Museum at Honolulu, Hawaiian Islands, the first to offer a complete account of the Ichthyology of Guam.)

*Sealeina lippincottianus* (Cope). Fig. 57.

*Myletes lippincottianus* Cope, Proc. Amer. Philos. Soc. Phila., XI, 1869-70 (August 19, 1870), p. 561, fig. (teeth). Cotype, No. 8,024, A. N. S. P. Para, Brasil. De Schulte Buckow.—Cope, *l.c.*, p. 566 (type).

Width of head  $1\frac{1}{2}$  in its length; interorbital space  $2\frac{1}{2}$  in head, measured from tip of upper jaw. Edges of body all more or less rounded. Head compressed, becoming a little constricted below. Snout broad and convex. Mouth broadly transverse. Tongue elongate, little free. Interorbital space broadly convex. Gill-opening forward to posterior nostril. Rakers about  $10 + 15$ , lanceolate, about  $\frac{1}{2}$  of pupil. Filaments about  $\frac{1}{2}$  of eye. Tubes in lateral line simple. Color in alcohol pale brassy-brownish, back darker or more brownish from level with upper edge of gill-opening. Fins all more or less plain pale brownish, and without markings. Iris brassy. Length  $3\frac{1}{2}$  inches (caudal lobes a little damaged). Cotype.

I restrict the specimen described above as one of Cope's cotypes, as it is possible his description is based on more than one example. The statements that there are 32 abdominal serratures and that the adipose fin is  $\frac{2}{3}$  the length of the rayed dorsal do not agree with my example.

*Metynnis luna* Cope. Fig. 58.

Proc. Amer. Philos. Soc. Phila., XVII, 1877-78 (May 17, 1878), p. 692. Type, No. 21,443, A. N. S. P. Peruvian Amazon. Prof. J. Orton.

Width of head  $2\frac{1}{2}$  in its length; interorbital space  $2\frac{1}{2}$ . Body greatly compressed. Snout broad and with surface convex. Lips thin. Teeth rather small, above with both series close together, 5 on each side externally and 4 annectant transversely. In mandible 4 on each side, median 4 largest, and in turn middle pair each with a large posterior cusp. Each tooth with at least a median point, those of mandible also with cutting edge, and inner series of upper jaw with 2 cusps to each tooth. Tongue not free, thick. Interorbital space broad and convex. Gill-opening forward to front margin of pupil. Rakers  $26 + 26?$ , slender, about  $\frac{1}{2}$  of eye, and filaments about  $\frac{1}{2}$  of latter. Some of tubes in lateral line simple. Color in alcohol brownish, back somewhat dark and plumbeous, and all of lower regions brassy and

silvered. Fins uniform dull brownish. Iris reddish-brown. Length  $2\frac{7}{8}$  inches (caudal damaged). Type.

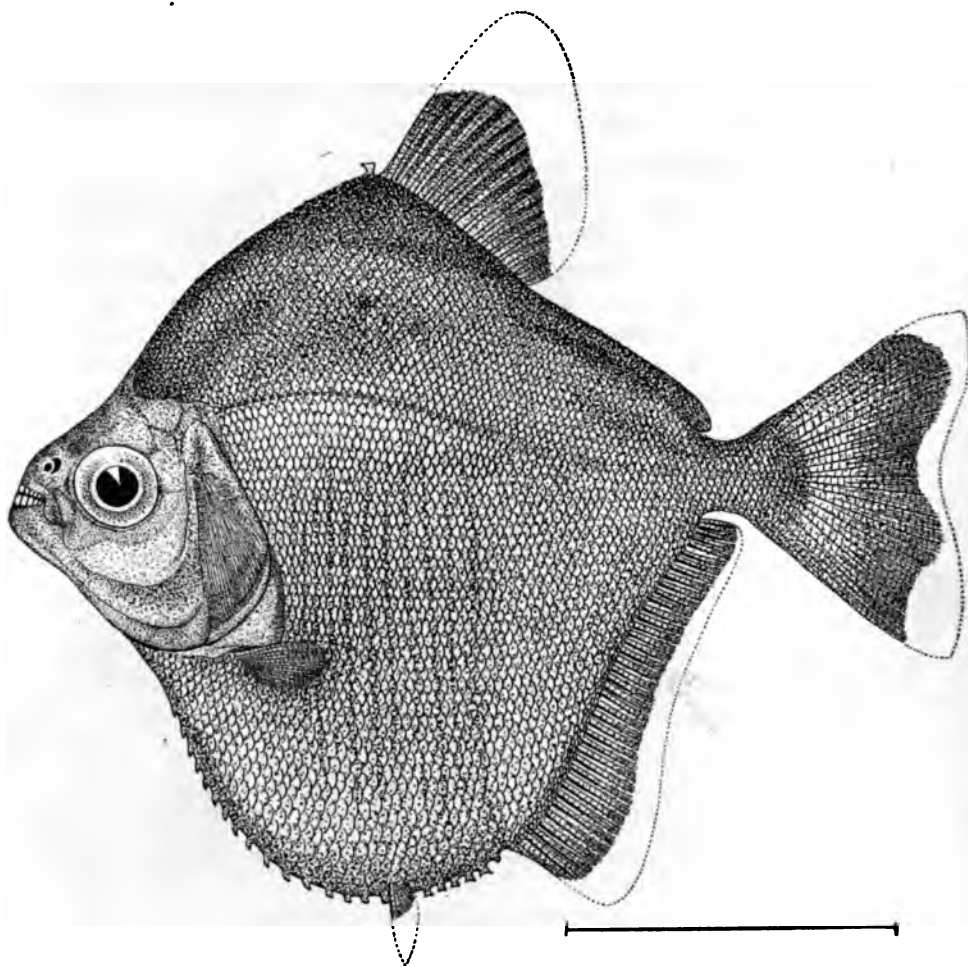


Fig. 58.—*Metynnis luna* Cope

Cope's statement that "the head enters the latter [*i.e.*, length of body without caudal] three and two-tenth times" is incorrect, as I find it about  $2\frac{1}{2}$ .

*Stethaprion erythrope* Cope. Fig. 59.

Proc. Amer. Philos. Soc. Phila., XI, 1869-70 (August 19, 1870), p. 562, fig. (2). Type, No. 8,031, A. N. S. P. Pebas. John Hauxwell.

Width of head  $1\frac{1}{2}$  in its length; interorbital space  $2\frac{1}{2}$  in head, meas-

ured from tip of upper jaw. Body greatly compressed and edges, except rounded upper and lower surfaces of caudal peduncle, with a slight median ridge. Head a little robust, compressed, and becoming a little constricted below. Snout broadly convex. No palatine teeth, others as in *Astyanax*. Tongue a little long, not free. Inter-

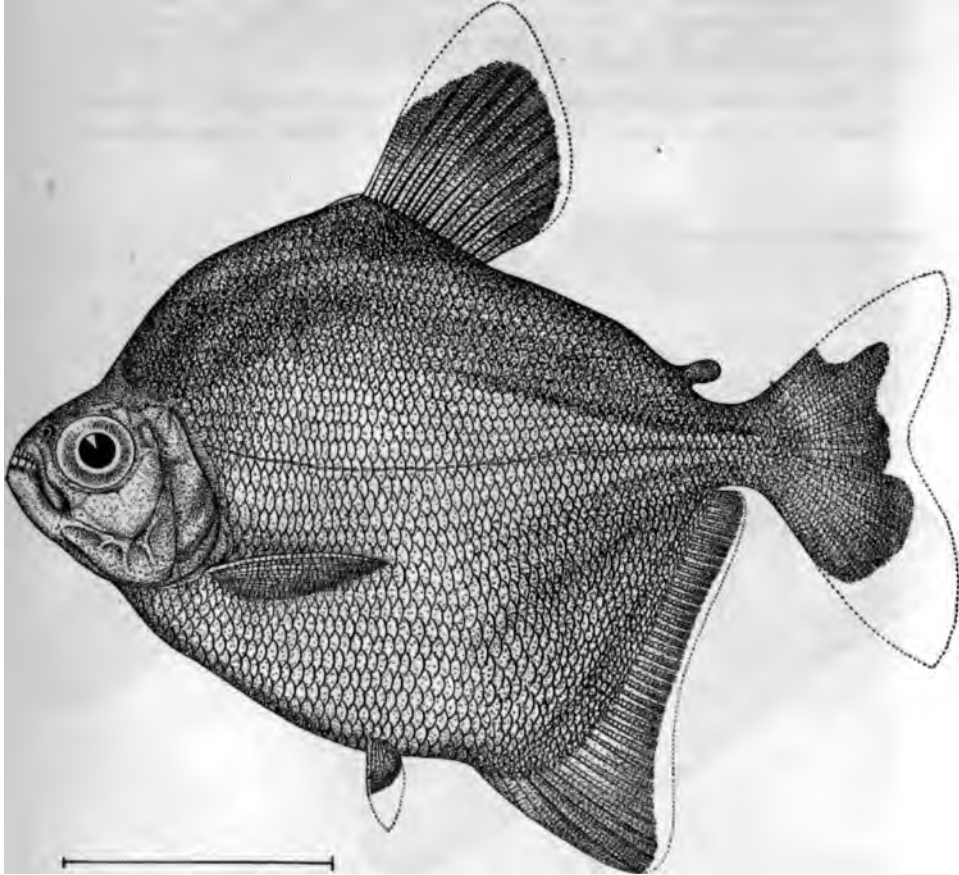


Fig. 59.—*Stethaprion erythrops* Cope.

orbital space broad and convex. Gill-opening forward nearly opposite front of eye. Rakers 13 + 14, lanceolate, and a little less than pupil. Filaments 2 in eye. Tubes in lateral line simple. Vent close in front of anal. Color in alcohol pale brownish, back a little darker, and body more or less with brassy-silvery reflections. A dull leaden and pale streak along posterior or straight portion of lateral line. Fins all dull

brownish. Side of head silvered. Iris deep reddish-dusky. Length  $3\frac{9}{16}$  inches (caudal damaged).

Owing to Cope's imperfect figure I have substituted the accompanying one, made from the type.

*Stethaprion chryseum* Cope. Fig. 60.

Proc. Acad. Nat. Sci. Phila., 1871 (1872), p. 261. Type, No. 8,030, A. N. S. P. Ambyiacu River. John Hauxwell.—Cope, Proc. Amer. Philos. Soc. Phila., XVII, 1877-78 (May 17, 1878), p. 692. Peruvian Amazon. Prof. J. Orton.

Width of head 2 in its length; interorbital space  $2\frac{1}{4}$  in head, measured from tip of upper jaw. Gill-rakers 9 + 13. Color in alcohol more

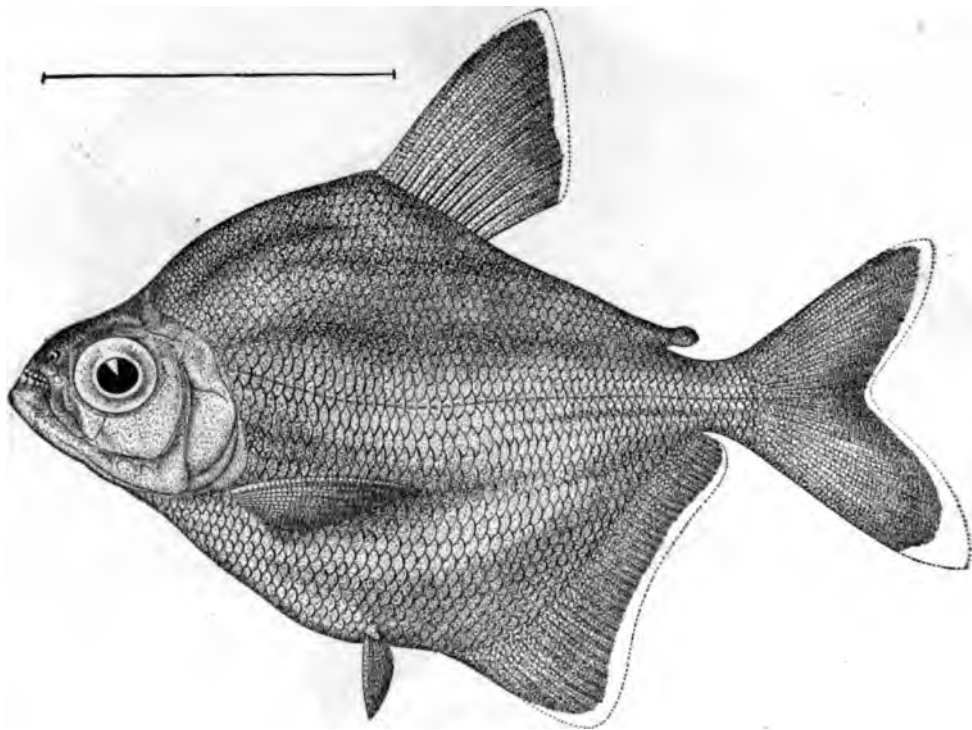


Fig. 60.—*Stethaprion chryseum* Cope.

or less uniform brown. In most respects similar to the preceding Length  $2\frac{1}{2}$  inches (caudal damaged). Type.

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In Part I of this paper a number of figures have been blurred by the printer, and as this may cause confusion in their comparison I give a list with explanations.

In the following figures the portions indicated are blurred:

- P. 298, fig. 4, *Curimata spilura*. Snout, interorbital space and side of mandible.  
P. 314, fig. 14, *Prochilodus theraponura*. Snout.  
P. 316, fig. 15, *P. amazonensis*. Snout, tip of first branched dorsal ray and lower pectoral rays.  
P. 332, fig. 21, *Cheirodon pulcher*. Upper surface of snout, end of rayed dorsal and median caudal rays.  
P. 336, fig. 24, *Hemigrammus robustulus*. Tip of upper caudal lobe.  
P. 337, fig. 25, *Astyanax ipanquianus*. Teeth, iris in front, breast, greater basal portion of pectoral fin together with scales just above, and anterior rays of anal basally.  
P. 340, fig. 28, *Astyanax huxwellianus*. Tips of jaws and ends of anterior long dorsal rays.

## ON SOME FISHES OF WESTERN CUBA.

BY N. E. McINDOO.

During the latter part of June and the first part of July, Mr. J. D. Haseman and the writer, under the auspices of the Zoological Department of Indiana University, visited twenty-one caves between Alacranes and Cañas, Cuba, in order to secure embryos of the blind fishes—*Stygicola* and *Lucifuga*.

We also collected fishes in the fresh waters and in the ocean at Marianao and at Batabano. These are enumerated in the present paper. The expenses were in part provided by a grant from the Carnegie Institution.

After collecting blind fishes we made our headquarters at the Estacion Central Agronomica de Cuba, located at Santiago de las Vegas. I wish to express our appreciation for the numerous favors which the Director, Prof. E. S. Earle, of the Station, showed us.

## LOCALITIES VISITED.

*Lagunas Castellanos.* Two and one-half miles southwest of Santiago de las Vegas there are three small lagoons situated in a narrow valley. These lagoons are called the "Lagunas Castellanos." Laguna Castellano No. 1 covers about five acres, has steep banks; its bottom is a mixture of mud and gravel, and its water is comparatively clear.

Laguno Castellano No. 2 lies about three hundred yards north of No. 1. It is not as large as No. 1. Its banks are very sloping and covered with aquatic plants which extend into the water one-third the distance to the center. The bottom is deep, black mud. The water is very muddy.

We did not visit Laguna Castellano No. 3, which is somewhat larger than either of the other two and lies a half mile due west of them.

All the fishes we caught in the clear water of Laguna Castellano No. 1 are dark in color; those that came from the muddy Castellano No. 2 are light in color.

*Rio Almendares.* We seined in the Almendares river at Calabazar for a half mile below the wagon bridge. Under the bridge the water is deep and swift, but thirty feet below the stream widens and the water is shallow. Here the bottom is covered with gravel and large

rocks. It was scarcely possible to seine with success in the river below this point on account of the swift water and steep banks.

*Batabano* lies on the southern shore of Cuba, nearly due south of Havana. The country about Batabano is very low, a semi-swamp. The entire region between Havana and Batabano, with the exception of a few miles drained by the Almendares river, is drained by underground streams. One of these finds its exit at the Vento Springs, near Havana, and supplies Havana with its water. Two others find their exit near Batabano, one of which arises some distance inland from Batabano and sends a stream six to ten feet wide and about two feet deep through the central part of Batabano.

The other stream arises about three hundred yards from the ocean and flows through the western part of the town. The water is clear and sluggish. Both of these streams run due south and empty into the ocean one-fourth of a mile apart. We seined in the larger stream just north of town, where the water was rather sluggish and the bottom muddy. We used the dip net in town, because it was impossible to handle the seine among the stakes along the banks.

While at Batabano we seined in the ocean along the western side of the wharf, and at the mouth of the small stream in the western part of town. The water is very shallow and the bottoms muddy. Our success was very poor.

*Marianao* is a small town eight miles west of Havana. On account of the rough rocks which form tide pools, it was impossible to use the seine at Marianao, but three-fourths of a mile northwest the water is shallow and the rocks are covered with sand. Here we had success with the seine. Between this place and Marianao we caught several fishes in the tide pools with our hands or with dip net. The following species were collected in these various localities.

#### FRESH-WATER FISHES.

##### POCILIIDÆ.

The members of this family are everywhere abundant.

*Cyprinodon riverendi* (Poey).

Six small specimens from the stream just north of Batabano.

*Fundulus cubensis* Eigenmann.

Four small specimens from the stream just north of Batabano. This species seems to be rather rare. It has so far been recorded from Pinar del Rio only.

*Gambusia punctata* Poey.

Everywhere abundant. Both males and females were caught in the

Almendares river at Calabazar, at the mouth of a small stream emptying into the ocean at Marianao and Laguna Castellano No. 2. The specimens from this lagoon are very light colored and have a more elongate body than the other specimens.

***Gambusia punoticulata* Poey.**

Very abundant. Our specimens were caught at Calabazar and in Laguna Castellano No. 1. Those from the latter place were collected by Prof. Baker, of the Estacion Central Agronomica de Cuba.

***Poecilia vittata* Guichenot.**

Found everywhere. Our specimens from Lagunas Castellanos Nos. 1 and 2, from Calabazar and from the stream north of Batabano. All the specimens from Laguna Castellano No. 1 are dark colored; both males and females were caught in Laguna Castellano No. 2 and every one is light in color. All the females contain eggs. Those caught at Calabazar and at Batabano are dark colored, which is due to the clear water.

**CICHLIDÆ.**

The individuals of the genus *Heros* are quite common everywhere. They are as abundant in the streams of western Cuba as are the sun fishes in Indiana. They vary greatly in coloration.

***Heros tetraoanthus* (Cuvier & Valenciennes).**

Many specimens caught in the Lagunas Castellanos. Those from Laguno Castellano No. 1 are very dark colored; some of them are dark brown and approach a black, while others are much lighter in color. Most of the scales with a dark brown spot at base, these spots forming faint longitudinal series; head, preoperculum and operculum darker than other parts of body; preoperculum with three almost black lengthwise streaks; dorsal, anal, and caudal with dark spots.

The following is the color description of a specimen from Laguna Castellano No. 2. Background flesh color, black dots forming indistinct and discontinuous longitudinal streaks; snout ashy without dark spots; preoperculum and operculum with four discontinuous lengthwise streaks; ventrals and anal ashy; pectorals flesh color; caudal without basal spot; caudal and dorsal with dark spots.

***Heros tetraoanthus cinetus* Eigenmann.**

From Laguna Castellano No. 2 and the stream north of Batabano. Those from Laguna Castellano No. 2, as all other specimens from the same place, are light in color. Each one is barred conspicuously. The specimens collected at Batabano are much darker.



**Gobiidæ.**

*Dermatator maculatus* (Bloch).

Several specimens from Laguna Castellano No. 1. Comparatively light in color.

**MARINE FISHES.****ESOCIDÆ.**

*Tylosurus euryops* Bean & Dressel.

Several from the mouth of the stream in the western part of Batabano. They are very swift and difficult to catch.

**ATHERINIDÆ.**

*Atherina laticeps* Poey.

Several specimens from Marianao.

**MUGILIDÆ.**

*Mugil trichodon* Poey.

Several were caught at Batabano, west of the wharf.

**MULLIDÆ.**

*Upeneus maculatus* (Bloch).

One specimen from Marianao.

**CARANGIDÆ.**

*Caranx ruber* (Bloch).

Several from Marianao.

*Trachinotus falcatus* (Linnaeus.)

One specimen from Marianao.

**LUTIANIDÆ.**

*Neomænis apodus* (Walbaum).

One small specimen from Marianao.

*Neomænis synagris* (Linnaeus).

Several were collected at Marianao.

**HÆMULIDÆ.**

*Bathystoma rimator* (Jordan & Swain).

Many from Marianao.

**GERRIDÆ.**

*Uluema lefroyi* (Goode).

Two specimens from Marianao.

*Eucinostomus pseudogula* Poey.

Six specimens from Marianao.

*Eucinostomus meeki* Eigenmann.

Two specimens from Marianao.

**SOLÆNIDÆ.**

*Bairdiella rosenus* (Cuvier & Valenciennes).

One large and three small specimens from Marianao.

**POMACENTRIDÆ.**

*Abudefduf saxatilis* (Linnaeus).

Eight specimens from Marianao.

*Eupomacentrus leucostictus* Gill.

Three small specimens from Marianao.

**SCARIDÆ.**

*Sparisoma hoplomystax* (Cope).

Several specimens from Marianao.

**GOBIIDÆ.**

*Gobius seporator* Cuvier & Valenciennes.

Two large and two small specimens from Marianao.

**BLENNIIDÆ.**

*Labrisomus nuchipinnus* (Quoy & Gaimard).

Three specimens from Marianao.

**PLEURONECTIDÆ.**

*Platophrys lunatus* (Linnaeus).

Two small fishes from Marianao.

## NOVEMBER 6.

The President, SAMUEL G. DIXON, M.D., in the Chair.

Twenty-six persons present.

MR. WITMER STONE made a communication on the recently acquired Tristram collection of birds, illustrating his remarks by the exhibition of specimens. (No abstract.)

The Publication Committee reported that papers under the following titles had been presented for publication:

“New Oribatidæ from the United States,” by Nathan Banks.

“Descriptions of New Species of Polychæta from the Southeastern Coast of Massachusetts,” by J. Percy Moore.

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NOVEMBER 20.

The President, SAMUEL G. DIXON, M.D., in the Chair.

Fifty persons present.

DR. BENJAMIN SHARP made a communication on the history and habits of the fur seal, illustrated by lantern views. (No abstract.)

The following were accepted for publication:

## NEW ORIBATIDÆ FROM THE UNITED STATES.

BY NATHAN BANKS.

The Oribatidæ, or "beetle-mites" as they have been called because of their hard teguments, have been but little collected or studied in our country. In 1895 the writer described those he had observed on Long Island, N. Y., and a few others. In 1896 a few more were added to the list. Now I describe twenty-four more, from various parts of the country.

Our Oribatid fauna is similar to that of Europe, so far but one or two peculiar genera; but we have a larger percentage of smooth species, as *Galumna*, *Oribatula*, and fewer of the roughened species, as *Notaspis*, *Nothrus*, and *Cepheus*. The genus *Pelops*, represented in Europe by ten or twelve species, has not yet been found in North America.

*Galumna slossonæ* n. sp.

Color, dark brown, a pale spot at base of abdomen, legs pale. Cephalothorax with a long lamella each side, its apical third free and pointed, bearing a rather short bristle; a narrower lamella or ridge on each outer edge, ending in a short bristle; superior bristles long, erect; pseudostigmatic organ long, clavate at tip. Abdomen longer than broad, smooth, with six rather thickened bristles each side, two toward humerus, four near tip; wings quite long, not one-half as high as long; genital opening about twice its length in front of the larger anal opening; sternum with three lines each side, middle pair longest. Legs quite long and slender; femora I and II very broad, femur II with a pointed lobe at tip beneath; all tibiæ with two stout spines at tip, one on patella II, and one below tarsi IV; three strongly unequal claws, the middle one very much larger than the others; a large tectopedium behind coxa I.

Length .5 mm.

From Franconia, N. H. (Mrs. A. T. Slosson.)

*Galumna unimaculata* n. sp.

Color, red brown, a yellowish spot at base of the abdomen. Cephalothorax with a rather broad lamella each side, its apical fourth free, tip slightly emarginate, and with a short bristle; superior bristles rather fine, long; pseudostigmatic organ not very long, clavate at tip. Abdomen large, globose, rather longer than broad, four pale smooth spots on each side, the basal pair much larger than the others; nine bristles

each side, two submedian toward base, one humeral, rather longer than others, four on posterior part, and two on the posterior margin; wings large, nearly as high as long, projecting a little in front of the abdomen, evenly rounded below; both wings and abdomen evenly, minutely granulate; genital opening twice its length in front of larger anus; venter granulate; sternal plate with two lines each side. Legs short and small, high up on the sides, leg IV not near as long as width of the body; with fine hairs as usual; three equal claws.

Length 1 mm.

Franconia, N. H. (Mrs. A. T. Slosson.)

*Galumna nitidula* n. sp.

Dark red brown, no basal spot on abdomen; legs pale yellowish. Cephalothorax very small and short, a lamella along each side, two-thirds the way to tip, its tip free and ending in a short bristle; superior bristles very short; pseudostigmatic organ rather short, fusiform. Abdomen plainly longer than broad, high, without hairs, smooth and shining, venter also; wings very small, angulate in front; genital opening one and one-half its length in front of much larger anal opening; sternal plate with two furrows across, hind margin of hind coxæ running into middle of genital opening; legs very short and small; the tarsi equal to the tibiae; three equal claws.

Length .7 mm.

From Franconia, N. H. (Mrs. A. T. Slosson.)

*Galumna persimilis* n. sp.

Color, dark brown, a pale spot at base of abdomen, legs pale yellowish. Cephalothorax with a broad lamella each side, its apical third free and ending in a long bristle, on outer side a long, erect pointed lamella, ending in a quite long bristle, a short lamella each side on tip of cephalothorax, higher in middle than at either end; superior bristles long, erect; pseudostigmatic organ short and clavate. Abdomen smooth, globose; nine bristles each side, those toward apex thickened and almost clavate, one humeral, three near middle of each side, and five toward tip; wings not very large, much longer than high, triangular, but rounded below; venter smooth; genital opening twice its length in front of larger anus; a pair of bristles behind anus; sternal plate with three lines each side, middle longest. Legs short and slender; tarsi as long as tibiae; a spine-like, barbed bristle beneath each patella, and two at tips of tibiae; femur IV margined beneath; a large tectopedium behind coxa I; three equal claws.

Length .5 mm.

From Franconia, N. H. (Mrs. A. T. Slosson.) Differs from *G. slossonæ* by equal claws, very short pseudostigmatic organs, etc.

*Galumna imperfecta* n. sp.

Color, pale yellow brown, legs paler. Cephalothorax with a rather broad lamella on each side, reaching one-half way down, with a long hair at tip; superior bristles long, erect; pseudostigmatic organ very long, clavate at tip. Abdomen large, barely longer than broad, not very high, smooth and shining, no hairs; wings of moderate size, triangular, one-half as high as long, not projecting in front of abdomen, outer lower corner rounded; venter smooth; genital opening fully twice its length in front of the much larger anal opening, a short transverse line a little in front of the anus; sternum with three transverse grooves, the posterior two run into the genital opening, the other is angulate on middle, but does not reach the sides. Legs rather short, femora broad, tarsi about as long as tibiae, but one claw to each tarsus.

Length .6 mm.

Several from Indianapolis, Ind. (Blatchley.)

*Galumna minuscula* n. sp.

Color, yellowish brown, legs paler. Cephalothorax with a lamella each side, connected near tip by a translamella, a rather long barbed hair from near base of tip; on each outer edge a low marginal lamella, which ends in a long bristle; superior bristles long, and barbed; pseudostigmatic organ very short, capitate. Abdomen globose, smooth, without hairs, its outline in front not complete; venter smooth; genital aperture one and one-half its length in front of larger anal opening, a transverse ridge shortly behind anus, which is fully as broad in front as behind; sternal plate with a line each side in front of genital opening, and a dot each side in front of this; wings small, not projecting in front of abdomen, the lower anterior corner rounded. Legs short; the femora broad, especially II and IV, and margined above with bristles before middle; tarsi equal to tibiae.

Length .5 mm.

From Bay Ridge, Md. Differs from *G. maesta* Bks. by having a translamella, and by less divided sternal plate.

*Galumna armipes* n. sp.

Color, dark brown, a yellow spot on base of abdomen, cephalothorax and legs yellowish. Cephalothorax with a broad lamella on each side, reaching nearly to tip of head, it terminates in a short, curved bristle, just above the translamella is a pair of short bristles, no superior bristles; pseudostigmatic organ spatulate, porrect. Abdomen longer

than broad, its dorsum minutely roughened, without hairs, wings finely granulate, not very long, but nearly as high, margin evenly convex; ventral surface finely granulate; the genital opening not quite its length in front of the larger anal opening, the latter broader behind than in front, where it tapers roundedly; sternal plate with three furrows each side, the second being the longest. Legs rather short; tarsi longer than tibiae, two barbed spines below on tarsi I and II, one on tibiae I and II, also on tarsi and tibiae IV; hind femora margined below.

Length .4 mm.

From Falls Church, Va., and Fort Lee, N. J.

*Galumna virginica* n. sp.

Color, pale yellowish. Cephalothorax with a broad lamella each side, its apical two-fifths free, and tipped by a long bristle; a low ridge outside each lamella; superior bristles erect, not very long, barbed; pseudostigmatic organ very long, clavate at tip. Abdomen longer than broad, depressed, smooth, without hairs; wings very long, not one-half as high, rounded below; venter smooth; genital opening once and one-half its length in front of the very much larger anus; sternal plate with three lines each side. Legs rather short and stout; femora III and IV margined below; bristles under tarsi and tip of tibiae are stout and barbed; tarsi I and II plainly longer than tibiae, tarsi III and IV hardly as long as tibiae; three equal claws.

Length .5 mm.

From Falls Church, Va.

*Galumna turgida* n. sp.

Color, reddish brown, legs paler. Dorsum smooth; cephalothorax with a lamella each side reaching more than half-way down, a narrow transverse ridge connecting the lateral ones; inferior and superior bristles barbed, the latter very long; pseudostigmatic organ very short, capitate; abdomen very large, globose, without hairs; wings not very large, longer than high, rounded below; genital opening more than twice its length in front of the much larger anal aperture; from the hind coxae there is a line obliquely up on each side to the dorsum. Sternum with a line each side toward anterior margin of the genital opening, and in front of this a dot each side; behind on each side is a short line. Legs moderately long, femur I rather swollen above, femora III and IV only slightly margined below; tarsi longer than tibiae; three equal claws.

Length .6 mm.

Several from Palm Springs, California. (Hubbard.)

*Galumna texana* n. sp.

Color, dark red brown, pale spot at base of abdomen, and legs pale yellowish. Cephalothorax short and broad, nearly smooth, superior bristles long, porrect, inferior bristles short, lamellæ indistinct; pseudostigmatic organ quite long, clavate at tip. Abdomen high and broad, two black notches on front margin, surface finely punctate; wings very large, long and broad, rather coarsely punctate, its lower margin entire. Venter more roughly rugose, almost reticulate; genital opening once and two-thirds its length in front of the much larger anal opening; the latter is much broader behind than in front. Coxæ IV very widely separate; the sternal plate with a line each side; legs small and very slender, with a few hairs in usual positions.

Length .7 mm.

One specimen from San Antonio, Tex., August.

*Oribatula pallida* n. sp.

Color, pale yellowish. Cephalothorax smooth above, with a lamella each side reaching one-half way to tip, a long bristle at each tip, superior bristles long and erect; pseudostigmatic organ quite long, clavate at tip. Abdomen much longer than broad, smooth above, without hairs, no distinct wings, but at each anterior corner a shelf-like projection; genital opening more than twice its length in front of the very much larger anal opening; a transverse furrow behind coxæ II pointing toward genital aperture, in front and behind this furrow is a line on each side, but no line from hind coxæ to genital opening. Legs slender tarsi all a little longer than the tibiae; all with fine hairs.

Length .38 mm.

One specimen from Fort Lee, N. J..

*Liacarus carolinensis* n. sp.

Color, dark brown, legs paler. Cephalothorax with two pairs of lamellæ, the inner pair are quite broad, and touch on inner side toward base, leaving a broad triangular space above, each with free tip and a long bristle, outer lamella narrow, and nearly reaches tip of head, with a bristle at apex; pseudostigmatic organ rather long, not barbed. Abdomen elongate, tapering behind, smooth above, no hairs; venter very minutely punctate; genital opening small, more than three times its length in front of the very much larger anal opening, the latter more than twice as long and more than twice as broad as the genital opening, and longer than broad; the posterior margin of body seen from below shows three short fine bristles each side, the inner pair shorter than the others; sternal plate with three complete transverse lines, hind margin



of coxæ IV running into the genital opening slightly in front of the middle; a large tectopedium behind coxæ I. Legs very slender; tarsi I and II slightly longer than tibiæ; tarsi III and IV much shorter than those tibiæ; three spine-like bristles below tarsi III and IV, and those on these tibiæ are rather short; three equal claws.

Length 1.1 mm.

One specimen from Black Mountain, N. C. (Beutenmüller.)

*Lisocarus abdominalis* n. sp.

Color, red-brown, legs paler. Cephalothorax, with a broad submedian lamellæ, nearly touching before tip, their apical fourth free, and tipped by a long bristle, a long, low outer ridge or lamella, reaching nearly to tip of head and ending with a short bristle; superior bristles very long, erect, simple; pseudostigmatic organ of moderate length, swollen toward tip and then tapering to a fine point. Abdomen elongate, smooth, no hairs above; venter smooth; fine hairs each side of anus, and a pair behind; genital aperture very small, fully three times its length in front of anus, the latter more than twice as long, and twice as broad as the genital opening; sternal plate with three complete furrows. Legs slender, the hind pair do not reach tip of abdomen; a large tectopedium behind coxa I; tarsi I and II as long as tibiæ, tarsi III and IV much shorter than tibiæ; all the hairs are fine; three equal claws.

Length 1 mm.

One specimen from Claremont, Cal. (Baker.)

*Lisocarus frontalis* n. sp.

Pale yellowish brown, legs paler. Cephalothorax with two low lamellæ each side, the submedian pair nearly meet somewhat beyond middle of cephalothorax, and are tipped with long, porrect bristles, the marginal lamellæ reach nearly to tip of head and end in short bristles; the superior bristles are long, simple, and erect; pseudostigmatic organ rather long, fusiform, its tip acute. Abdomen nearly circular, not very high, smooth, without hairs; venter smooth; genital opening circular, one and one-fourth its length in front of much larger anal opening, the latter evenly elliptical; sternal plate with three transverse lines, all complete, hind margin of coxæ IV running into middle of genital opening. Legs slender, with simple hairs; tarsus I shorter than tibia I, tarsus IV nearly as long as tibia IV; three equal claws; mandibles large and stout, palpi very distinct.

Length .5 mm.

From Falls Church, Va.

***Notaspis castanea* n. sp.**

Color, red brown, legs paler. Cephalothorax with a broad lamella each side, nearly touching before the tip, the tip deeply excavate, leaving a sharp point each side, from middle of tip arises a long simple bristle; superior bristles short, erect; pseudostigmatic organ short and fusiform, with a pointed tip, in length not more than one-third the width of the cephalothorax. Abdomen somewhat longer than broad, broadest in middle, dorsum minutely punctate, without bristles. Whole under surface of body strongly punctate, and uniformly so; genital aperture twice its length in front of the larger anal opening, the latter longer than broad. Sternal plate transversely divided by a furrow much nearer to the posterior than to the anterior margin. Legs rather slender, IV longer than width of body at that point; tarsus I shorter than the tibia; a sharp-pointed tectopedium behind coxa I.

Length .95 mm.

One specimen from Humboldt, Cal.

***Notaspis carbonaria* n. sp.**

Color, shining jet black, legs yellowish. Cephalothorax with a broad lamella each side, extending beyond head, tip excavate, but the inner point much longer than outer, from middle of tip arises a long simple bristle; superior bristles as long as cephalothorax, simple; pseudostigmatic organ slender, simple, rather longer than one-half the width of cephalothorax. Abdomen elongate, more than three times as long as cephalothorax, and tapering behind; densely pitted above and below. Venter with a curved ridge behind, extending forward each side in front of anal aperture, and almost traceable to hind coxæ. Genital aperture with hind border about as far forward as hind margin of hind coxæ, fully three times its length in front of the anal aperture, the latter nearly twice as broad and twice as long as genital opening. Sternal plate divided by a transverse furrow. Legs short and weak, IV not more than two-thirds of width of body at that place; all tarsi short, the first much shorter than tibia I, and bearing a hair beyond its middle more than one-half longer than joint; claws three.

Length 1.4 mm.

One specimen from Humboldt, Cal.

***Oppia spinipes* n. sp.**

Color, pale yellowish brown, legs paler, lamellæ blackish. Cephalothorax with a pair of low, submedian lamellæ, the apical third free, and terminating in a long barbed bristle; a short lamella each side near apex of head, and ending in a short bristle; superior bristles long, porrect,

finely barbed; pseudostigmatic organ quite long, barbed, not thickened at tip. Abdomen globose, with four, rather long, barbed bristles behind; genital aperture scarcely its length in front of the larger anal opening; sternal structure as in *O. bipilis*, the hind furrow running into middle of genital opening, a transverse furrow in front of this, and in front of latter is a short furrow on each side. Legs quite long and slender; femora III and IV very broad, and margined below, II moderately broad, I pedicellate; tarsi III and IV with two or three stout, barbed, spine-like bristles; a long, barbed bristle from trochanter III; three claws.

Length .4 to .7 mm.

Several examples from Falls Church, Va. This is strictly congeneric with *O. bipilis* of Europe.

*Oppia canadensis* n. sp.

Color, pale yellow. Cephalothorax with lamellæ like *O. spinipes*, but they are much longer, nearly one-half the length is free; the superior bristles are rather longer; the pseudostigmatic organs about the same. The abdomen has four long bristles behind, the submedian pair plainly longer than in *O. spinipes*; the abdomen above and below is slightly roughened; genital opening its length in front of larger anus, latter with two bristles each side, and a pair behind; sternal structure as in *O. spinipes*; hind coxæ large and broad; a long bristle from trochanter III; the spine-like bristles on hind tarsi are rather more slender than in *O. spinipes*.

Length .7 to .85 mm.

Several from Ottawa, Canada. (Harrington.)

*Oppia montana* n. sp.

Color, pale yellowish. Cephalothorax with lamellæ as in allied species, fully one-third of length free; superior bristles very long, barbed; the barbed pseudostigmatic organ is longer than in *O. spinipes*. The abdomen is globose, with six short hairs behind, the superior median pair longer than the others, but all much shorter than in *O. spinipes* and *O. canadensis*; genital aperture one and one-fourth its length in front of the somewhat larger anus, sternal structure as in allied species; legs long and slender, the barbed bristles not very stout; a barbed bristle on trochanter III.

Length .5 mm.

From Franconia, N. H. (Mrs. A. T. Slosson.)

*Cepheus lamellatus* n. sp.

Color, red brown, legs paler, lamellæ pale brown, reticulate. Cephal-

othorax triangular, with a broad lamella each side, broader near tip than at base, and the tip trilobed, the middle lobe giving rise to a curved, simple bristle; a pair of smaller bristles on tip of head. Superior bristles long and rather thick. Seta about one-half the width of the cephalothorax, and clavate at tip. Abdomen nearly circular in outline, not very high, above densely and roughly reticulate with rather heavy ridges, with ten pairs of thick bristles, all minutely barbed; one on each shoulder, two each side back and inward from this, three in a submarginal row on each posterior side, and four each side on posterior margin, two of them being near the tip, and rather more clavate than the others. Legs rather slender, with hairs in usual arrangement, long ones from tip of tibia and near middle of tarsus. Coxæ separated, but coxæ II united on the median line; coxæ III and IV very short, especially the latter, these giving room for the genital aperture, which is not one-half its length in front of the much larger anal opening; venter finely irregularly rugose.

Length .65 mm.

One specimen from Blue Hill, Mass., October.

*Oribata puritanica* n. sp.

Color, dark red brown, legs paler. Cephalothorax triangular, surface smooth, two pairs of curved bristles near tip, an erect bristle near base of each pseudostigmatic organ, the latter straight, thick, and nearly as long as width of cephalothorax at that point. Abdomen globose, smooth, with five pairs of stout, fusiform bristles above; a basal pair pointing forward on extreme front margin of abdomen, the others behind in a submarginal row each side; a pair of longer, curved, simple bristles at tip. Venter smooth; genital and anal apertures touching; anal plates with two or three striæ, and each aperture with two simple bristles each side, and two behind anus. Sternal plate with a broad, deep furrow each side. Legs slender; I barely longer than body, IV plainly longer; joints swollen at tips, and each with several long, curved bristles near tip; tarsi very slender; but one claw.

Length 1 mm.

One specimen from Middlesex Fells, Mass., October.

*Oribata longiseta* n. sp.

Color, pale yellowish brown. Surface above and below smooth. Cephalothorax with an apical pair of short bristles, and a stout black bristle each side on vertex, near the pseudostigma. The pseudostigmatic organ, long and slender, with a curved and barbate tip, plainly longer than width of cephalothorax. Abdomen globose, with scattered

fine erect bristles, about 25 of them, none long; three in front and two rows each side behind, those on apical third longer and thicker than others, but the last pair short. Venter smooth; genital and anal openings touching, the latter more elongate; a pair of short bristles just behind anus, and a transverse, black ridge just before tip; sternal plate with a dark furrow each side. Legs slender; the joints nodose; I a little longer than body, IV plainly longer, tarsi extremely slender; femora I and II plainly larger than others; all with curved bristles, mostly plumose, at least near tip, that from patellar joint of leg IV extremely long, and plumose at tip, another very long, simple hair at tip of tibia IV; but one claw. A short, sharp spine behind coxa I, a larger one behind coxa II.

Length .75 mm.

Several specimens from Falls Church, Va., December.

*Neothrus taurians* n. sp.

Dull brown, rather paler in middle of the abdomen. Cephalothorax and abdomen roughened; a large curved process each side on tip of cephalothorax, a pair of bristles from near middle, and an irregular transverse ridge across base; pseudostigmatic organ short, and capitate. Dorsum of abdomen depressed, margins raised, four long erect bristles on each side, another more curved before tip, a straight one from each apical corner, and a submedian pair of curved ones at tip, a basal submedian pair of shorter ones, and a longer humeral pair, all very stout. Abdomen elongate, about twice as long as wide at base, only a little wider at tip; genital and anal openings about equal in size, and touching; the latter much before tip, and behind it each side are a couple of bristles. Legs short and heavy, all with a few curved hairs; femora broad at base; leg IV not reaching tip of body.

Length 1 mm.

One specimen from Falls Church, Va.

*Neoliodes floridensis* n. sp.

This species is similar in most respects to *N. concentricus* Say, but at once separated therefrom by the fact that the basal median part of the dorsum of the abdomen (on the first turn) is separated from the sides by a lateral ridge, and the enclosed space is densely granulate; in *N. concentricus* this part is longitudinally striate, and there is no lateral ridge. The apex of the abdomen above is not as high nor as pointed as in *N. concentricus*. The legs are somewhat shorter, but the most distinct difference in the legs is that in this species there is a large lobe below at apex of each femur, especially large on legs I and II; the tarsi

and pseudostigmatic organs are somewhat shorter. Color, black, a pale area each side at base of the cephalothorax.

Length .9 mm.

Many specimens from Lake Worth, Fla. (Slosson.)

#### EXPLANATION OF PLATES XIV, XV, XVI, XVII, XVIII.

PLATE XIV.—Fig. 1.—*Galumna slossonæ*.

Fig. 2.—*Galumna slossonæ*, wing.

Fig. 3.—*Galumna slossonæ*, legs I and II (below).

Fig. 4.—*Liacarus frontalis*.

Fig. 5.—*Liacarus frontalis*, leg I, and seta.

Fig. 6.—*Oribata puritanica*, seta, and hair from body.

Fig. 7.—*Oppia canadensis*.

Fig. 8.—*Galumna armipes*, wing, and tarsus I.

Fig. 9.—*Galumna armipes*.

PLATE XV.—Fig. 10.—*Oppia montana*.

Fig. 11.—*Galumna minuscula*.

Fig. 12.—*Oribata longiseta*, seta, and hair from body.

Fig. 13.—*Galumna persimilis*, wing.

Fig. 14.—*Cepheus lamellatus*.

Fig. 15.—*Galumna persimilis*.

PLATE XVI.—Fig. 16.—*Notaspis castanea*.

Fig. 17.—*Liacarus carolinensis*.

Fig. 18.—*Galumna virginica*.

Fig. 19.—*Neoliodes floridensis*, leg I.

Fig. 20.—*Galumna virginica*, wing.

Fig. 21.—*Galumna imperfecta*.

PLATE XVII.—Fig. 22.—*Oppia spinipes*.

Fig. 23.—*Nothrus taurinus*.

Fig. 24.—*Galumna texana*.

Fig. 25.—*Galumna turgida*, wing, and seta.

Fig. 26.—*Galumna turgida*.

Fig. 27.—*Galumna nitidula*.

PLATE XVIII.—Fig. 28.—*Oribatula pallida*.

Fig. 29.—*Liacarus abdominalis*.

Fig. 30.—*Notaspis carbonaria*.

Fig. 31.—*Notaspis carbonaria*, leg I.

Fig. 32.—*Liacarus abdominalis*, leg I.

Fig. 33.—*Galumna unimaculata*.

DESCRIPTIONS OF NEW SPECIES OF POLYCHÆTA FROM THE SOUTH-  
EASTERN COAST OF MASSACHUSETTS.

BY J. PERCY MOORE.

*Arabella spinifera* sp. nov.

This species is known only from an incomplete worm consisting of the prostomium and fifty-one anterior segments and measuring 18 mm. long and 2 mm. in diameter, indicating a form less elongated than *Arabella opalina* Verrill.

Prostomium subconical, very slightly depressed, acute, more than twice as long as the basal width; sides straight; ventral longitudinal grooves close together and very faint. The noteworthy elongation of the prostomium may be abnormal, resulting from an injury at the base. Eyes two, rather large, conspicuous, situated on the dorsum close to the posterior border of the prostomium and separated by a space of less than one-third the basal width of the prostomium. Palps rudimentary, or at least not visible from the exterior, and enclosed by the margins of the lips.

Peristomium and somite II clearly separated by a deep furrow, both dorsally and ventrally; both simple apodous rings, the former slightly the longer. Posterior lip smooth. Foot-bearing somites all very short, about 5-8 times as wide as long, all clearly defined by distinct furrows, simple in structure, and decidedly more arched dorsally than ventrally, making a subterete body.

Parapodia begin on III. The first (Plate XIX, fig. 3) consists of a small but prominent notopodium, and a neurapodium which is divided into a short and stout, rounded presetal lobe supported by a single stout aciculum, and a similarly formed but slightly longer postsetal lobe, which is ventral and only slightly posterior to the former. Remaining parapodia (fig. 4) are prominent, and the postsetal or ventral lobe is elongated into a stout cirriform branchial organ containing a large vascular loop. For the length of the piece the parapodia undergo no change, except, first, a slight increase in size of the postsetal lobe and, second, a scarcely perceptible reduction of it in the last ten or twelve somites.

On the first two or three parapodia the acicula do not project beyond the surface, but the neuropodia of all others are supported by

two deep yellow acicula, the ends of which are exposed as in certain species of *Drilonereis* and *Aracoda*. The dorsalmost (fig. 5, a) is much the stouter and the end is blunt; the more ventral (fig. 5, b), besides being more slender, is prolonged into an acute spinous process, which is frequently broken off. Further caudad the larger aciculum becomes still stouter and more distinctly curved. Two or three very fine acicula reach to the base of the notopodial tubercle (fig. 4).

On the first somite the setæ are all in a small, nearly vertical fascicle between the two lobes, but they quickly rotate to a more oblique position and divide into an oblique supra-acicular group and a horizontal subacicular group. The former usually contains two pairs of doubly curved, very acute, limbate setæ with strongly striated stems and finely denticulated margins (fig. 6); these are turned with profile dorsal and ventral. Subacicular setæ are two or three in a horizontal row, turned so that in preparations of the parapodia both blades come into view symmetrically; the blades are shorter and the tips more prolonged than on the supra-acicular setæ (fig. 7). Dorsal setæ yellow, ventral nearly colorless.

Mandibles (fig. 2) brown, with exposed tips white. The two halves merely touch without uniting and then diverge both distally and proximally; dentinal plate not clearly differentiated from the carrier and nearly equal to it in length; the former curved, divergent, ending in a blunt white tip, without marginal teeth; the latter relatively short, broad at distal, tapering to proximal end, divergent. Maxillæ (fig. 1) brown, four pairs, all but the first pair (forcep jaws) alternating in position and more or less asymmetrical. Carriers of forceps filiform, about twice the length of the series of jaws; the two halves coalesced near the end, thickened, then constricted and again enlarged at the distal end; the forceps roughly triangular, with three stout, hooked teeth along the medial margin of the basal half and the ends strongly hooked. The first accessory plate on the left side longer than the forceps plate, with a large hooked distal tooth and seven stout teeth gradually becoming smaller toward the proximal end. All of the remaining jaw plates differ little in size, but become successively somewhat smaller toward the anterior end; each is supported by two broad divergent wings and the dentinal ridge bears 4-6 conspicuous, slender, claw-like teeth, one or two of the anterior usually being enlarged.

Color of preserved specimen: anterior end and parapodia rich yellow, pale farther back; the cuticle only slightly iridescent.

The type and only known specimen (A. N. S. No. 2313) was found among a lot of *Ninoe nigripes* Verrill dredged on the muddy bottom of the middle of Buzzard's Bay, Mass., the exact spot being unknown.



*Praxillella tridistrata* sp. nov.

What appears to be an undescribed species of *Praxillella* is imperfectly represented by several fragments, one consisting of the head and nine metastomial segments, of which the head and five segments are in process of regeneration, a second of somites VI to XII inclusive, and a third of the pygidium and eight preanal segments, the first five of which are setigerous.

This is a larger species than *P. zonalis* or *P. elongata*, having a diameter of 3 mm. and an estimated length of about 150 mm. The only known anterior end, being in process of regeneration, presents an abnormal appearance, somewhat approximating that of a *Nicomache* or *Lumbriclymene*. The entire regenerating region, consisting of the prostomium and six somites, has a length of a trifle more than 3 mm. and barely exceeds the sixth segment.

Head very short, with the cephalic plate and limbate margin scarcely developed. There is a rather thick, short and broad palpode, and running back from it a narrower but, relatively to the width of the head, broad median ridge bounded on each side by the deep and conspicuous sensory clefts, which again are bounded laterally by the low folds from which the limbate margins will develop, the whole forming a narrow area scarcely exceeding one-third of the entire width of the head and sloping steeply downward anteriorly. Mouth a rather large crescentic opening bounded by the narrow, furrowed peristomial lip. Peristomium very short and uniannular.

Somites II to VI are about twice as long as wide, slightly compressed, distinctly biannular, decreasing slightly in diameter to the last, and with the furrows, except  $\frac{I}{II}$  which is obscure, well defined. No distinct collars. The integuments of this region are soft and delicate and a careful examination discloses no developed setæ, though the setigerous glands are visible on some segments.

The first normally developed segment (VI) is cylindrical, quite as long as the preceding part of the worm, and 2-3 times as thick; VII and VIII are quite similar; IX and X are united into one joint about four times as long as wide and without any dividing furrow; XI is slightly longer than VIII, and XII still longer. Except  $\frac{IX}{X}$  all furrows in this region are deep and distinct; the segments somewhat depressed and distinctly flattened ventrally. On VI, VII and VIII the parapodia are situated one-third of the length of the segment from its anterior end, and all of the area anterior to them is occupied by a thick, whitish, glandular zone; a similar zone exists on IX, while on X a thick, rugous, ventral, glandular area of triangular form extends

forward from and between the posterior tori to an apex halfway to the tori of IX, whence a narrow median ventral ridge continues it forward to the glandular zone of IX; XI and XII have no glandular areas, though the tori form prominent swellings near their posterior ends.

The posterior segments are much contracted and distorted, but it is evident that they consist normally of a slender, very contractile, and wrinkled anterior portion, and a short, enlarged, posterior parapodial portion. They decrease in length regularly to the pygidium, which is preceded by three achæitous segments, of which the first closely resembles the last setigerous in size, and has posterior swellings representing the parapodia; the next is about one-half and the next one-fourth as long, widest posteriorly, where there are slight parapodial thickenings. The last two gradually widen into the base of the pygidium.

Pygidium (Plate XIX, fig. 8) with a short basal ring resembling the last achæitous segment, and bearing a thick posterior anal disk, the margin of which is provided with a median ventral cirrus and a pair of lateral, long, slender cirri each having a length of  $\frac{3}{4}$  the diameter of the disk, together with a circle of very regular prominent teeth of which five are between the median and each of the lateral cirri, and fifteen between the two latter on the dorsum. Anus occupying the centre of a low, regular, finely furrowed cone, and closed by a thick, fleshy papilla; which arises from its ventral margin and bends dorsad. The usual raised neural line runs for the entire length and passes on to the ventral cirrus.

Setæ and uncini are undeveloped on the regenerating segments. They are sessile on VI-IX and borne on small papillæ and prominent tori on all the others. Anteriorly the setæ form small but very prominent, vertical, linear tufts, which become more compact posteriorly. They are similar on all segments. Anterior tufts contain 10-12 longer, stouter, slightly curved, narrowly limbate setæ (fig. 9), with long, capillary tips, and nearly twice as many slender, capillary, wingless setæ, partly smooth and partly bipinnate, with fine hairs (fig. 10). Farther back they become longer but fewer and in more compact bundles, and most of the wingless setæ are smooth.

The anterior thoracic crochets are of course unknown. On other segments there are 15-19, the larger numbers behind. They are pale yellow, strongly striated, with rather slender stem, slightly constricted to form a neck, but lacking a distinct shoulder; an expanded head with a short, stout beak; a low crest with about four large and two or three small, diminishing teeth flanked by small fibrous teeth; and a conspicuous guard composed of 5-6 stout flattened hairs united

at the base and in contact with the lower surface of the beak to its tip, above which they arch and recurve in a bold circle (figs. 11 and 12).

Living color and tube unknown. Filled with eggs on Sept. 2. Taken on two occasions at Crab Ledge, east of Chatham, Mass., in 17-20 fathoms, on a stony and gravelly bottom, and not found elsewhere. (Type No. 1253, Academy of Natural Sciences of Phila.)

*Cirratulus parvus* sp. nov.

Form very slender, terete, nearly linear, but most slender and attenuated posteriorly. Length 20-30 (usually about 25) mm., diameter about .6 mm. Number of segments 60-75.

Prostomium and peristomium united to form a distinct head (fig. 13). Prostomium broad and flat, broader than long, its width nearly two-thirds widest part of body, shaped like the blade of a gravedigger's shovel; the upper surface with a pair of obliquely transverse sensory slits at the place of union with the peristomium; the ventral surface somewhat thickened and divided by a longitudinal fissure. Eyes, one pair, conspicuous, rounded or slightly elongated obliquely, widely separated on middle of head, close to the sensory slits.

Peristomium a simple, somewhat swollen ring, scarcely differentiated from the prostomium above, but elsewhere clearly defined and forming a straight and smooth lip behind the relatively large mouth. Next two segments (II and III) simple rings with a diameter equal to the peristomium and a combined length equalling the entire length of the head.

Setigerous and branchiate somites begin with IV, which is slightly enlarged. They are at first quite short, but rapidly lengthen without corresponding increase in diameter until the length nearly or quite equals the diameter. Posteriorly they again diminish in length and at the caudal end is a short region of not clearly defined segments. All somites simple and uniannular, and the intersegmental furrows smooth and clear cut. Although the body is nearly terete the ventral surface is somewhat flattened and the parapodia somewhat projecting. Pygidium bearing a minute pointed projection below a nearly circular, dorsal anus.

Parapodia begin on IV and continue to posterior end; they are small, ventro-lateral projections bearing separate notopodial and neuropodial tubercles.

Branchial cirri also begin on IV just above the parapodia, and a pair occurs on each segment for about twenty, after which they are borne on every second or third segment and finally more scatteringly nearly to the posterior end. Cirri of the middle and posterior region are borne at the posterior margin of the segments some distance above the para-

podia. They are slender, filiform and round, often half as long as the body and with the base constricted so that they are easily detached.

Dorsal gills usually two pairs, sometimes a rudimentary third one on one or both sides, placed side by side on the dorsum of IV just above the parapodium and a little behind the branchial cirrus. They are slender at the base and swell to about twice the diameter of the branchial cirri, longer than the latter, longitudinally grooved for their entire length, and in contraction crenulate, wrinkled and more or less coiled in an open spiral.

Setæ and spines scarcely differ in form and structure from those of *Cirratulus grandis*. At the anterior end both notopodial and neuropodial tufts contain capillary setæ only—about 6–8 in each—of various lengths, the longest about two-thirds the body diameter. Spines appear in the neuropodium at about XII, and a few segments farther back each neuropodial tuft contains about four spines and four setæ, much shorter than on anterior segments (fig. 14). At the posterior end there are about two of each. In notopodial tufts the setæ become fewer and shorter from before backward, but usually spines appear only in those of the posterior one-third.

Color pale yellow or orange, usually with a greenish tinge, the integuments translucent, permitting the dark intestine to show through. Gills and cirri reddish from the contained blood.

Known only from the deeper waters of Vineyard and Nantucket Sounds, in from 10–19 fathoms, where it lives in colonies among the crevices of *Amarœcium pellucidum* and in passages of shells. Quite common in the latter at Crab Ledge, off Chatham. Nothing definite known of breeding habits, but specimens taken in late August contain small eggs. (Type No. 1657, Academy of Natural Sciences of Phila.)

This species is easily distinguished from young of *Cirratulus grandis* of the same size, which are frequently taken under stones at low water, by having but two achæitous segments between the peristomium and first branchial segment. It bears a close superficial resemblance to *Cirrhatus fragilis* Leidy, but differs decidedly in that the latter is described and figured as having bifid spines, only one apodous prebranchial segment, and the branchiæ beginning on the second setigerous segment. The species recorded under the name *Cirrhinereis fragilis* Quatrefages as having been dredged in Vineyard Sound, and considered by Verrill to be identical with *C. fragilis* Leidy, is probably the species here described.

***Amphitrite attenuata* sp. nov.**

Form slender, clavate, slightly swollen in the anterior thoracic

region, slender and tapering behind. Length 30 mm., diameter nearly 2 mm. at inflated part of thorax. Number of somites 80, IV-XXVIII setigerous.

Prostomium broad and depressed at the base, produced forward into a rather thick, simple lip, broadly rounded, entire and usually curved upward at the anterior margin, little folded about the mouth laterally and not meeting the lower lip; tentaculiferous ridge in contact with the lateral ends of the lip but separated from it by a slight notch, arched over the dorsum of the prostomium posteriorly and bearing in a continuous series about 30 coarse tentacles about one-half the length of the body. No eyes visible.

Mouth large, bounded below by a ventral lip which is divided by a transverse furrow into an inflated internal portion and a flat external portion, which is very broad and extends laterally beyond, but does not touch the upper lip. Peristomium a short, simple ring dorsally, expanded ventrally to form the lower lip. Somite II as long as the prostomium and ventral lip combined, its anterior margin without a true collar or lateral wings, but slightly produced as a free rim. Thoracic region distinctly segmented, the furrow complete and well defined; dorsal region most inflated at X-XII, thence gradually tapered to the abdomen. Abdomen attenuated, nearly quadrate in section, the dorsum only rounded; the segments becoming very short but all distinctly biannulated, the posterior borders wider and somewhat projecting. Pygidium a simple, rugous ring.

Ventral plates 14 (II-XV) all, except the first, sharply defined but in contact with one another; the anterior ones rectangular, 2-4 times as broad as long, the last four elliptical and one and one-half times to twice as broad as long. Posterior to the ventral plates a ventral groove with a raised neural line continues to the posterior end.

Gills (fig. 15) three pairs, on II, III and IV, decreasing in size from before backwards, all small; when fully extended the first not more than one-half the thoracic diameter, each with a short trunk dividing near the base into 2-4 main branches, each of which then dichotomizes, usually three times and terminates in slender, tapering twigs.

Setigerous papillæ begin on IV just beneath the last gill, and are represented in a corresponding position on III by a minute achæitous, knob-like papilla. Anteriorly they are prominent and at a high level; posteriorly they shift ventrad and become smaller. First torus on V, about one-half as long as the longest on XII, and one-sixth or one-seventh the body circumference. First five tori separated ventrally by about three times their length, those on XII by an interval about

equal to their length and succeeding ones by a less distance. Posterior to the region of ventral plates they become more elevated and prominent, but, though assuming a lappet-form, they never become largely free, even on posterior abdominal segments.

The characteristic setæ arise from short vertical lines in tufts of about a dozen arranged in double series. They (fig. 16) have remarkably broad limbi, those of the posterior row being shorter than and half again as broad as the one figured; the very slender and much attenuated tip is very long, and the fringe nearly obsolete and confined to the outer end on the long setæ, but better developed, though exceedingly delicate, on the short ones.

Uncini occur in single series pointing forward on V-X, in double series alternating in position and facing each other on XI-XXVIII, then again in single series to the end; there are about thirty-five on V, sixty on X and XI, thirty-six on XVIII and twenty on L. They are nearly colorless, with short, strongly convex bases deeply notched in front, the beak stout, the crest of four transverse rows of 3-9 teeth and the guard short and broad (fig. 17).

Color pale reddish salmon, deepest anteriorly, tentacles flesh color.

This species has been taken only on the piles of the New York Yacht Club wharf in Vineyard Haven, where it occurs sparingly below low water among *Cynthia* and *Amarœcium*; lives in small mud tubes and breeds in early July.

#### EXPLANATION OF PLATE XIX.

##### *Arabella spinifera*—figs. 1 to 7.

Fig. 1.—Ventral view of maxillæ, the accessory jaws slightly turned by pressure.  $\times 56$ .

Fig. 2.—Dorsal view of mandibles.  $\times 56$ .

Fig. 3.—Outline of parapodium III, posterior aspect.  $\times 56$ .

Fig. 4.—Anterior view of parapodium X.  $\times 56$ .

Fig. 5.—Distal ends of the two acicula.  $\times 250$ .

Fig. 6.—Profile view of a moderately elongated seta from X.  $\times 250$ .

Fig. 7.—Face view of a short subacicular seta from X.  $\times 250$ .

##### *Praxillella tricirrata*—figs. 8-12.

Fig. 8.—Pygidium and caudal achætoous segments  $\times 9$

Fig. 9.—Slender capillary seta from XI.  $\times 250$ .

Fig. 10.—Bipinnate capillary seta from XI.  $\times 440$ .

Fig. 11.—An entire crochet from XI.  $\times 82$ .

Fig. 12.—End of crochet.  $\times 360$ .

##### *Cirratus parvus*—figs. 13 and 14.

Fig. 13.—Anterior end showing the branchiæ and branchial cirri.  $\times 24$

Fig. 14.—A tuft of notopodial cirri from the middle region.  $\times 250$ .

##### *Amphitrite attenuata*—figs. 15 to 17

Fig. 15.—First gill of the left side.  $\times 24$ .

Fig. 16.—A thoracic seta in  $\frac{1}{2}$  view.  $\times 360$

Fig. 17.—A thoracic uncinus.  $\times 360$ .

## DECEMBER 4.

MR. ARTHUR ERWIN BROWN, Vice-President, in the Chair.

Fifty-one persons present.

The death of Robert P. Morton, a member, December 1, 1906, was announced.

Messrs. GEORGE and WILLIAM S. VAUX, Jr., made a report on their studies of the glaciers of the Canadian Rockies and the Selkirks, supplementary to the communication of April 17. The two papers will be combined and published later.

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DECEMBER 18.

The President, SAMUEL G. DIXON, M.D., in the Chair.

Thirty-seven persons present.

The following were ordered to be printed :

## SOME NEW AND LITTLE-KNOWN PERCOID FISHES.

BY HENRY W. FOWLER.

In this paper I give an annotated list of the more generalized percoid fishes of special interest to be found in the collections of the Academy of Natural Sciences of Philadelphia. Other papers dealing with remaining families are expected to follow.

Owing to the more general acceptance of the view among naturalists that the first species under a genus be considered the type, I abandon the process of elimination. Cases only apply where no type is designated or tautonymy is not inferred. Further I shall retain words different only etymologically, though with a strict adherence to the original orthography, even when erroneous, provided there is no evidence contrary.

## DULEIDÆ.

This name supersedes *Kuhliidæ*, as *Kuhlia* Gill, *Proc. Acad. Nat. Sci. Phila.*, 1861, p. 48 (type *Perca ciliata* Cuvier specified = *Centropomus rupestris* Lacépède), is superseded by *Dules* Cuvier, *Règne Animal*, Ed. 2, II, 1829, p. 147 (type *Centropomus rupestris* Lacépède by first species).

*Dules marginatus boninensis* subsp. nov. Fig. 1.

Head 3; depth  $2\frac{1}{2}$ ; D. X, 11; A. III, 12; P. I, 13; V. I, 5; scales 50 in lateral line to base of caudal, and several more on latter; 6 scales obliquely back from origin of spinous dorsal to lateral line; about 13 scales between origin of spinous anal in a vertical series to lateral line; width of head 2 in its length; depth of head over posterior margin of pupil about  $1\frac{1}{2}$ ; mandible  $2\frac{1}{2}$ ; fifth dorsal spine  $1\frac{1}{2}$ ; first dorsal ray  $1\frac{1}{2}$ ; third anal spine  $2\frac{1}{2}$ ; first anal ray 2; least depth of caudal peduncle  $2\frac{1}{2}$ ; pectoral  $1\frac{1}{2}$ ; ventral  $1\frac{1}{2}$ ; ventral spine  $2\frac{1}{2}$ ; snout 4 in head measured from tip of upper jaw; eye 3; maxillary  $2\frac{1}{2}$ ; interorbital space  $3\frac{1}{2}$ .

Body compressed, rather deep, lower profile a little more evenly convex than upper, and greatest depth falling about midway in post-ventral region. Back but slightly elevated, and with but a slight keel a short distance in front of spinous dorsal, otherwise edges of body rounded. Caudal peduncle compressed, its least depth about  $1\frac{1}{2}$  in its length.



Head rather large, compressed, upper profile nearly straight from tip of snout to origin of spinous dorsal, and lower a little more inclined and convex. Snout rather short, its length about  $\frac{3}{4}$  its width, and

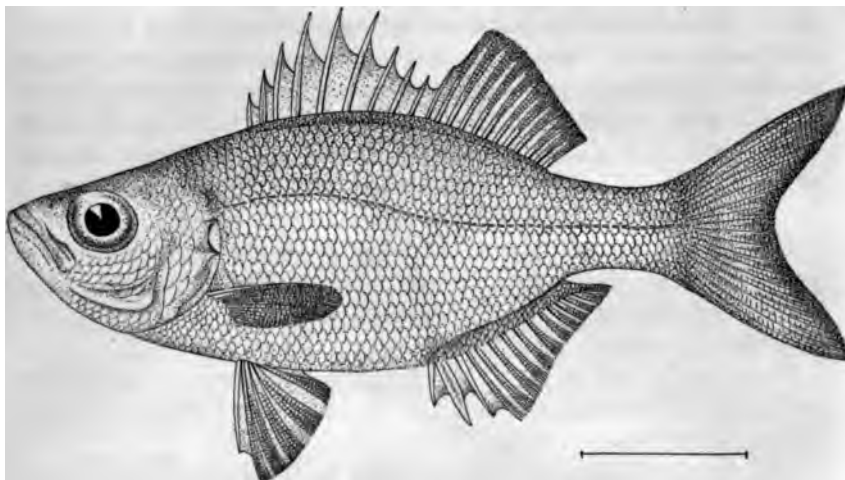


Fig. 1.—*Dules marginatus boninensis* Fowler. (Type.)

rather truncate in front. Eye rather large, rounded, high and anterior, or posterior margin of pupil about midway in length of head. Mouth inclined, moderate, opening superiorly, and with mandible protruding in front. Maxillary narrow, free for about half its length, and its distal expansion about  $\frac{1}{4}$  diameter of pupil. Teeth in jaws rather small, in bands. Vomer and palatines with patches of minute teeth. Tongue rather narrow, edentulous, pointed, and free in front. Buccal membranes rather narrow. Nostrils close together, superolateral, and much nearer front of eye than tip of snout. Interorbital space a little broad, slightly convex, and with frontal ridges little prominent. Margin of preorbital dentate. Lower margin of preopercle finely dentate, and posterior margin entire. Opercle with 2 flat backwardly directed pointed spines, well separated, and lower larger. Suprascapula with several rather coarse serratures.

Gill-opening extending forward about opposite front margin of orbit. Gill-rakers 10+21, lanceolate, slender, finely asperous inside, and longest about  $\frac{1}{4}$  of orbit. Gill-filaments a trifle less than diameter of pupil. Isthmus narrowly compressed, and with a median groove.

Scales finely ctenoid, above lateral line in series parallel with its course, below in horizontal series, along bases of vertical fins small and

crowded, and in about 4 series on cheek. Lateral line of simple tubes, and concurrent with dorsal profile.

Origin of spinous dorsal behind that of ventral, spines graduated from fifth, though fourth and sixth subequal, and margin of fin deeply notched. Last dorsal spine longer than second, though shorter than third. Rayed dorsal begins about midway between origin of pectoral and base of caudal, highest from first ray, though without lobe. Origin of spinous anal falling about opposite origin of rayed dorsal, third spine longest, and rayed fin similar to rayed dorsal. Caudal deeply emarginate, lobes pointed. Pectoral short, reaching about  $\frac{2}{3}$  of space to anal. Ventral inserted behind origin of pectoral, and reaching a little over  $\frac{1}{3}$  of space to origin of spinous anal.

Color in alcohol pale brown, back slightly leaden, and lower surface paler. Fins all plain pale brownish, margins of dorsals, and caudal posteriorly, slightly dusky. Iris brassy-yellow.

Length  $5\frac{1}{4}$  inches.

Type, No. 11,556, A. N. S. P. Bonin Islands, between lat.  $26^{\circ} 30'$  and  $27^{\circ} 44'$  N. and long.  $140^{\circ}$  and  $143^{\circ}$  E., in the North Pacific. Smithsonian Institution (No. 347).

This form is apparently closely related to *Dules marginatus* Cuvier. It differs from Tahiti examples of that species, however, in having more scales in the lateral line. In this respect it agrees with Hawaiian and Tahiti examples of *Dules mato* Lesson, though the latter differs principally in having more gill-rakers. Examples of *Dules rupestris* (Lacépède) from Samoa and Tahiti have the caudal but slightly emarginate.

(Named for the Bonin Islands.)

BOULENGERINA subgen. nov.

Type *Dules mato* Lesson.

Gill-rakers more numerous than in subgenus *Dules*. *Boulengerina* has 24 to 28 on the lower part of the first arch, while *Dules* has 16 to 20.

The specific name of the typical species dates from *Dules mato* Lesson, *Voy. Aut. Mond. Coquille, Zool.*, III, 1830 (March 22, 1828), p. 223, thus having priority over *Dules malo* Valenciennes, *Hist. Nat. Poiss.*, VII, 1831, p. 360. *Kuhlia malo* now in use must thus give way to *Dules mato*.

(Named for Dr. George A. Boulenger, of the British Museum, well known among naturalists for many excellent works relative to the lower vertebrates.)

## MICROPTERIDÆ.

This name supersedes *Centrarchidæ* as *Centrarchus* Cuvier, *Hist. Nat. Poiss.*, III, 1829, p. 62 (type *Cychla ænea* Le Sueur by first species = *Bodianus rupestris* Rafinesque), and is therefore a synonym of *Ambloplites* Rafinesque. This leaves *Eucentrarchus* Gill, *Amer. Journ. Sci. Art.*, XXXVII, 1864, p. 93 (type *Labrus irideus* Lacépède = *Labrus macropterus* Lacépède) as the proper name for the round bass, with the subfamily name changed from *Centrarchinæ* to *Eucentrarchinæ*. Therefore as *Micropterus* Lacépède is the oldest genus in this family the above name may be framed for it.

I have also examined *Elassoma zonatum* Jordan. *Elassoma* probably represents a distinct family, as has been contended.

***Pomoxis annularis* Rafinesque.**

Sedalia and St. Joseph, Mo. (Drs. D. S. Jordan and S. E. Meek); White River, Ark. (Drs. D. S. Jordan and C. H. Gilbert); Leavenworth, Kan. (E. D. Cope). Both this and the next show some variation.

***Pomoxis sparoides* (Lacépède).**

Davenport, Ia. (Dr. S. E. Meek); lower James River, Va. (E. D. Cope); Lake Huron (E. D. Cope); Leavenworth, Kan. (E. D. Cope); Sandusky, O. (Smiths. Inst.); South Carolina (Dr. J. E. Holbrook); New Orleans, La. (J. M. Florat); Neuse River, N. C. (E. D. Cope).

***Eucentrarchus macropterus* (Lacépède).**

North Carolina (U. S. N. Mus.); South Carolina (Dr. Blanding); Bayport, Fla. (E. D. Cope).

***Ambloplites rupestris* (Rafinesque).**

Richmond, Miami and Wabash Rivers, Ind. (E. D. Cope); Brook River and Michigan City (E. D. Cope), and Fort Dodge, Ia. (Dr. S. E. Meek); Detroit, Mich.? (E. D. Cope); Lake Superior (Dr. J. H. Slack); Wisconsin (Smiths. Inst.); Blue River, Ind. (E. D. Cope); Holston and lower James Rivers, Va. (E. D. Cope); Cumberland River, Tenn. (E. D. Cope); French Broad and Yadkin Rivers, N. C. (E. D. Cope); Lake George, N. Y. (W. S. Vaux); Texas (Dr. S. W. Woodhouse).

***Ambloplites rupestris cavifrons* (Cope). Fig. 2.**

*Ambloplites cavifrons* Cope, *Journ. Acad. Nat. Sci. Phila.*, VI, 1866-69 (December, 1868), p. 217. Type, No. 12,803, A. N. S. P. Headwaters of the Roanoke River, Montgomery county, Va. E. D. Cope.

Width of head  $2\frac{3}{4}$  in its length; interorbital space  $4\frac{1}{4}$  in head, measured from tip of upper jaw. Lips rather fleshy laterally. Rami of mandible well elevated inside mouth. Teeth small, curved, pointed, a

little irregular, and in bands in jaws. Vomerine teeth smaller, in an obtuse-shaped patch, and a narrow band on each palatine. Tongue rather thick, broad, rounded, and well free. A patch of small asperities on tongue. Interorbital space a little convex. A rather trenchant keel from occiput to origin of spinous dorsal. Gill-opening forward opposite front rim of pupil. Rakers iv, 1+6, vii, large, robust, and a little longer than filaments. Scales small and crowded on occi-

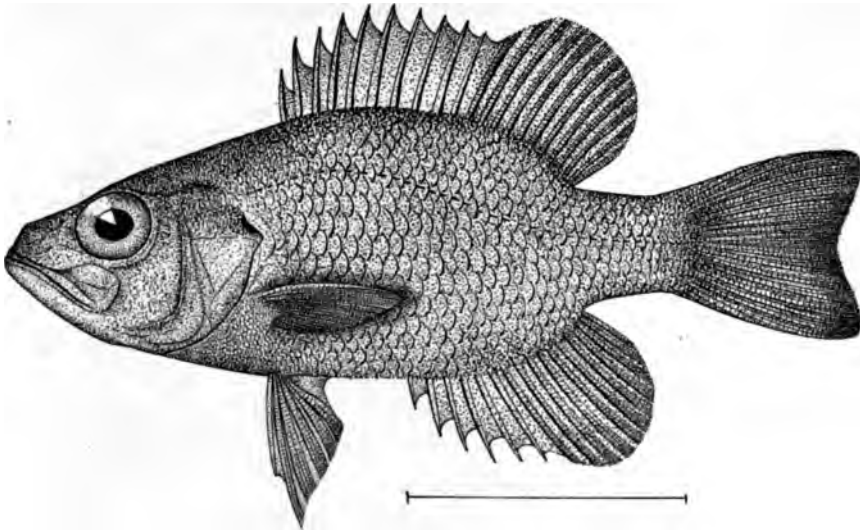


Fig. 2.—*Ambloplites rupestris cavifrons* (Cope). (Type of *Ambloplites cavifrons* Cope.)

put, predorsal region and thorax. Vent a little nearer tip of ventral spine than origin of spinous anal. In alcohol dull brown, more or less uniform on head and trunk, and fins paler. Faint traces of horizontal streaks following in series of scales. Very indistinct clouded mottlings on vertical fins. A brownish opercular spot. Iris dull brassy-silvery. Length 3 inches. Type.

***Archoplites interruptus* (Girard).**

*Centrarchus interruptus* Girard, Proc. Acad. Nat. Sci. Phila., 1854, p. 129. Cotypes, Nos. 13,430 (type) to 13,433, A. N. S. P. Sacramento River, Cal. Dr. A. L. Heermann. Coll. Smiths. Inst.

Another from same locality (U. S. F. Com.); San Joaquin River, Cal. (Dr. Newberry).

***Chenobryttus gulosus* (Cuvier).**

*Lepomis gillii* Cope, Journ. Acad. Nat. Sci. Phila., VI, 1866-69 (December, 1868), pp. 222, 225. Type, No. 12,789, A. N. S. P. Branch of Tuckahoe Creek, in the bottoms of James River, twelve miles above Richmond. E. D. Cope.

*Lepomis charybdis* Cope, *l.c.*, pp. 223, 224, was based on *Calliurus melanops* Girard, Proc. Acad. Nat. Sci. Phila., 1857, p. 200, from fresh waters of Texas.

One example taken from the stomach of an alligator from Taylor's Creek, Lake Okeechobee, Fla. (Prof. A. Heilprin); Volusia, Fla. (E. D. Cope); Neuse and Roanoke Rivers, N. C. (E. D. Cope); Mobile, Ala. (Mus. Comp. Zool.); San Diego, in Duval county, Tex. (E. D. Cope); Indiana (E. D. Cope).

***Enneacanthus gloriosus* (Holbrook).**

*Pomotis guttatus* Morris, Proc. Acad. Nat. Sci. Phila., 1859, p. 3. Type, No. 22,598, A. N. S. P. Vicinity of Philadelphia. Dr. J. Cheston Morris.

*Hemiplites simulans* Cope, Journ. Acad. Nat. Sci. Phila., VI, 1866-69 (December, 1868), p. 217, Pl. 22, fig. 7. Type, No. 13,449, A. N. S. P. Slow waters of Tuckahoe Creek, which enters the James River above Richmond, Virginia. E. D. Cope.

Dr. Boulenger confuses this species with the next in *Cat. Fish. Brit. Mus.*, Ed. 2, I, 1895, p. 19, as *Apomotis obesus*.

Neuces River, N. C., and lower James River, Va. (E. D. Cope).

***Enneacanthus obesus* (Girard).**

Volusia, Fla. (E. D. Cope), and Concord, Mass. (Dr. J. H. Slack). One of the examples on which Morris based his *Pomotis guttatus* is this species, however, as the name and intention are apparently to indicate the preceding species, it may be restricted to the same.

***Apomotis cyanellus* (Rafinesque).**

*Bryttus signifer* Girard, Proc. Acad. Nat. Sci. Phila., 1857, p. 201. Cotype, No. 13,187, A. N. S. P. Rio Medina, Texas. Dr. C. B. Kennerly. Smiths. Inst. (No. 422).

*Bryttus mineopas* Cope, Proc. Acad. Nat. Sci. Phila., 1865, p. 84. Cotypes, Nos. 13,190 to 13,194, A. N. S. P. Minneopa, Minnesota. J. H. Slack.

St. Joseph and Brownsville (Drs. D. S. Jordan and S. E. Meek), James River and Marshfield (Drs. C. H. Gilbert and S. E. Meek), and Greenfield, Mo. (Dr. S. E. Meek); Ames, Ia. (Dr. Meek); Fort Riley, Kan. (Dr. W. A. Hammond); Hicksville, O. (Dr. Meek); Blue River (E. D. Cope) and Miami River, Ind. (E. D. Cope); Leavenworth, Kan. (E. D. Cope); Archer county, Llano and Wichita Rivers, Tex. (E. D. Cope).

*Apomotis* is retained generically as the median posterior partition of the air-vessel is only slightly developed, while in the species of *Lepomis* examined it is usually well developed forwards.

***Lepomis punctatus* (Valenciennes).**

*Lepomis apiatus* Cope, Proc. Amer. Philos. Soc. Phila., XVII, 1877-78, p. 66.  
Cotypes, Nos. 11,127 to 11,132, A. N. S. P. Volusia, Florida. E. D. Cope.

Caloosahatchie River, Fla. (Prof. A. Heilprin).

***Lepomis auritus* (Linnaeus).**

A single example labeled "Roanoke River, Va., E. D. Cope," No. 13,058, A. N. S. P., may be typical of *Lepomis ophthalmicus* Cope, *Journ. Acad. Nat. Sci. Phila.*, VI, 1866-69 (December, 1868), pp. 223, 224. It would agree in length if the caudal were not included, though the measurements of the depth of the body at the origin of the soft dorsal and at the base of the fifth ray of this fin do not.

*Pomotis solis* Valenciennes, *Hist. Nat. Poiss.*, VII, 1831, p. 352, is apparently a composite species based on examples from Lake Ponchartrain, La., and Philadelphia, Pa. Primarily it seems to be restricted to the Louisianan form, as Dr. Jordan examined the types from Philadelphia and pronounced them as probably identical with *Eupomotis gibbosus*. Drs. Jordan and Evermann, in *Bull. U. S. Nat. Mus.*, No. 47, I, 1896, p. 1001, place the Louisianan fish as a distinct subspecies of *L. auritus*, stating that it has larger cheek scales, about 5 or 6 series, and a large dusky blotch on the last dorsal rays. Bollman, in *Rep. U. S. F. Com.*, 1888 (1892), p. 573, includes *Lepomis mystacalis* Cope as a synonym, and is followed by others, though from my own examination of the types of this latter it is found to be identical with *Lepomis palladus* Mitchill. That the Florida form is not appreciably different upon comparison of alcoholic examples of *L. auritus* from Bayport, Fla. (E. D. Cope); South Carolina (Dr. J. E. Holbrook); Catawba and Yadkin Rivers, N. C. (E. D. Cope); Lake George, N. Y. (W. S. Vaux), I am satisfied. The original account of *Pomotis solis* is hardly complete enough for certainty of identification.

***Lepomis megalotis* (Rafinesque). Fig. 3.**

*Lepomis peltastes* Cope, Proc. Amer. Philos. Soc. Phila., XI, 1869-70, pp. 453, 454. Cotypes, Nos. 12,978 to 12,981, A. N. S. P. Huron River, Michigan. Prof. Alexander Winchell.

*Lepomis haplognathus* Cope, *l.c.*, XXII, 1885, p. 168. Cotypes, Nos. 18,888 to 18,889, and 20,397 to 20,398, A. N. S. P. Monterey, Nuevo Leon, Mexico. E. D. Cope.

This is a most variable species, both in color and structure, especially with reference to the opercular flap. It is possible that *Lepomis occidentalis* Meek, *Field Col. Mus. Pub.* 65, Chicago, III, No. 6, 1902, p. 118, Pl. 29, and *L. haplognathus* Cope may exhibit characters in color to render them distinct races of *L. megalotis*. Certainly *L. haplognathus*, judged from the alcoholic types, cannot be distinguished

from the very large series of specimens of *L. megalotis*, which covers every variation. Dr. Meek's accounts do not leave it clear to me that his *L. occidentalis* is really distinct. Besides *L. megalotis* Cope, *l.c.*, XI, 1869-70, p. 452, examples representing *L. nitidus* Cope, *l.c.*, p. 453, and *L. longispinis* Cope, *Proc. Acad. Nat. Sci. Phila.*, 1865, p. 83, have been examined, and found to be this species. Llano River, Fort Worth, Wichita River, upper Medina River and Dallas (E. D. Cope), Delaware

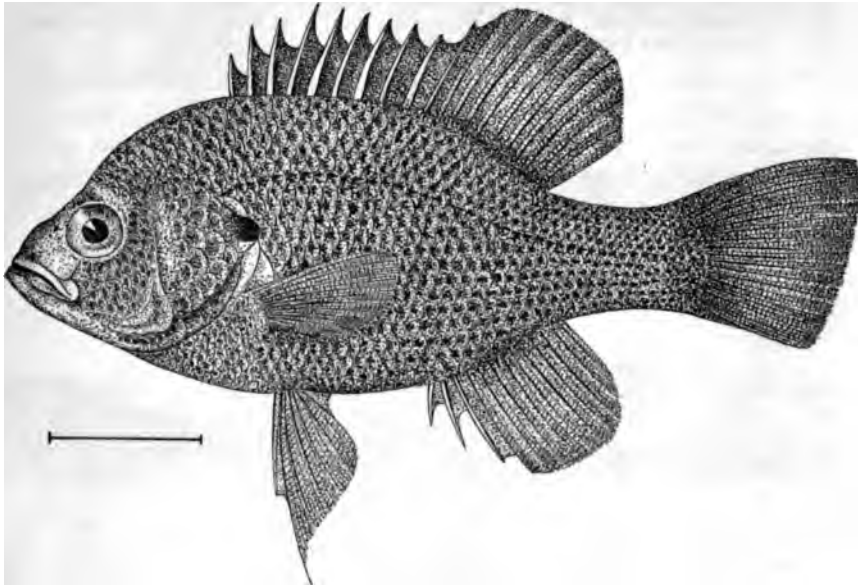


Fig. 3.—*Lepomis megalotis* (Rafinesque). (Type of *Lepomis haplognathus* Cope.)

Creek (Capt. Pope), Brazos River (Dr. Shumard), and Comanche Creek, Tex. (Smiths. Inst.); Goodland, Ind. Ter. (Dr. S. E. Meek); Eureka Springs (Drs. D. S. Jordan and C. H. Gilbert), Paragold (Dr. Meek), Greenway (Dr. Jordan), and Fort Smith, Ark.; Brook River, Ia. (E. D. Cope); Marshfield, Mo. (Drs. Gilbert and Meek); Leavenworth, Kan. (E. D. Cope); Racine, Wis. (U. S. Nat. Mus.); Detroit? (E. D. Cope), Mich. (Dr. Pitcher); Wabash, Blue and Miami Rivers, Ind. (E. D. Cope); Coal Creek, Tenn. (E. D. Cope); Thomasville, Ga. (J. A. G. Rehn).

***Lepomis humilis* (Girard).**

*Bryttus humilis* Girard, *Proc. Acad. Nat. Sci. Phila.*, 1857, p. 201. Cotypes, Nos. 13,166 to 13,168 and 13,154, A. N. S. P. Sugar Loaf Creek, Arkansas. H. B. Mollhäusen. Smiths. Inst. (No. 428).

*Bryttus oculatus* Cope, Proc. Acad. Nat. Sci. Phila., 1865, p. 83. Cotypes, Nos. 13,146 to 13,153, A. N. S. P. Lake Whittlesey, Minn. J. H. Slack.

*Lepomis anagallinus* Cope, Journ. Acad. Nat. Sci. Phila., VI, 1866-69 (December, 1868), p. 221. Type, No. 13,145, A. N. S. P. Leavenworth, Kansas. Samuel H. Edge.

Arthur (Dr. S. E. Meek), and Fort Worth, Tex. (E. D. Cope); Greenfield (Dr. Meek), Marshfield (Drs. C. H. Gilbert and S. E. Meek), and St. Joseph, Mo.; Fort Riley, Kan. (Dr. W. A. Hammond).

*Lepomis macrochirus* Rafinesque. Fig. 4.

*Lepomis nephelus* Cope, Journ. Acad. Nat. Sci. Phila., (2) VI, 1866-69 (December, 1868), p. 222. Type, No. 22,619, A. N. S. P. Kiskiminitas River, West Pennsylvania. A. H. Guss.

Width of head  $2\frac{1}{2}$  in its length; interorbital space  $3\frac{1}{2}$  in head measured from tip of upper jaw. Edges of body mostly rounded and but slightly trenchant just before origin of spinous dorsal. Head compressed with sides flattened. Length of snout about  $\frac{1}{2}$  its width. Lips a little

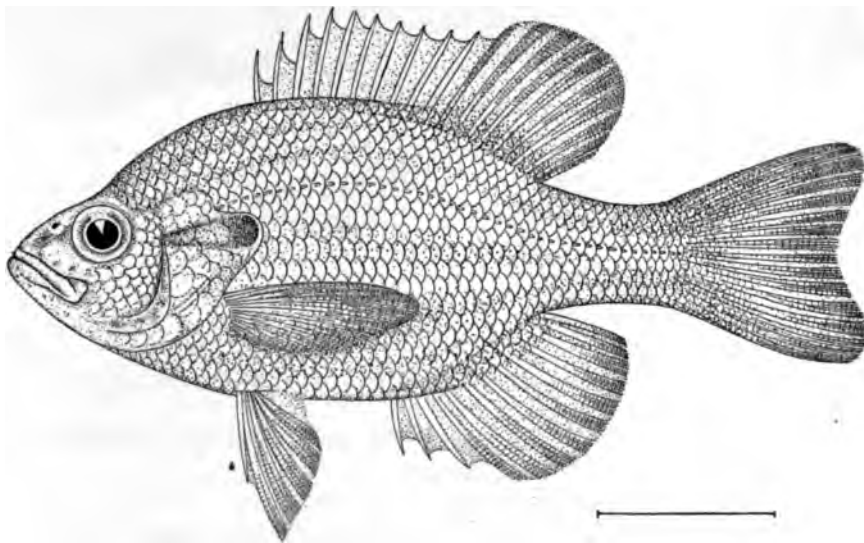


Fig. 4.—*Lepomis macrochirus* Rafinesque. (Type of *Lepomis nephelus* Cope.)

fleshy. Teeth rather coarse, pointed, conic, and in bands in jaws, those on vomer smaller. No palatine teeth. Tongue smooth, rather fleshy, a little pointed and free in front. Each ramus of mandible a little elevated inside mouth. Interorbital space slightly convex. Gill-opening forward to front margin of pupil. Rakers II, 2+10, II, lanceolate, and about equal to filaments or  $\frac{1}{2}$  of eye. An adnate scaly



tract between bases of ventrals. Vent about midway, or a little behind, between tips of ventral spines and origin of spinous anal. Color in alcohol faded brown, belly and lower surface of body scarcely paler. Fins all pale brown, scarcely darker towards edges. Opercular blotch blackish-brown, in size about  $\frac{3}{4}$  of eye, and from opposite level of latter a dull brownish shade extends from upper end of preopercular margin to opercular blotch, increasing to its width in its course. Iris warm brownish. Inside of gill-opening pale, opercular blotch appearing equally blackish-brown as on outside. Length  $4\frac{1}{2}$  inches. Type.

***Lepomis palladus* (Mitchill).**

*Lepomis longispinis* Cope, Proc. Acad. Nat. Sci. Phila., 1865, p. 83. Cotypes, Nos. 16,562 to 16,564, A. N. S. P. From St. Louis to Southern California. Dr. A. L. Heermann.

*Lepomis ardesiacus* Cope, Journ. Acad. Nat. Sci. Phila., VI, 1866-69 (December, 1868), p. 222. Type, No. 13,106, A. N. S. P. Kiskiminitas River, Western Pennsylvania. Addison R. Guss.

*Lepomis purpureus* Cope, Proc. Amer. Philos. Soc. Phila., XI, 1869-70, pp. 453, 454. Cotypes, Nos. 13,066 to 13,077, A. N. S. P. Tributary of the Yadkin River in Roane county, North Carolina. E. D. Cope.

*Lepomis mystacalis* Cope, Proc. Amer. Philos. Soc. Phila., XVII, 1877-78, p. 66. Cotypes, Nos. 27,834 to 27,836, A. N. S. P. Volusia, Florida. E. D. Cope.

These do not differ, though they show about 48 scales, and all agree with examples from Lake Okeechobee. Other examples from Volusia differ, however, most strikingly in the short gill-rakers. One has 54 scales in the lateral line. Another agrees with the figure of *Pomotis elongatus* Holbrook, Journ. Acad. Nat. Sci. Phila., (2) III, 1855-58 (May, 1855), p. 47, Pl. 5.

Examples representing *Pomotis speciosus* Baird and Girard, Rep. Expl. Surv. R. R. Miss. Pac., X, Fish., 1858, p. 23, Pl. 8, figs. 5-8; *P. fallax* Girard, l.c., p. 27, Pl. 8, figs. 9-12, Pl. 9, figs. 5-12, Pl. 10, figs. 1-7, and *Lepomis notatus* Cope, Proc. Amer. Philos. Soc. Phila., XI, 1869-70, p. 453, have been examined. This species is very variable.

French Broad River, N. C. (E. D. Cope); South Carolina (Dr. J. E. Holbrook); Volusia and opposite mouth of St. Lucie River (E. D. Cope), Caloosahatchie River, Fla. (Prof. A. Heilprin); Coal Creek, Tenn. (E. D. Cope); Amana, Ia. (Dr. S. E. Meek); Leavenworth, Kan. (E. D. Cope); Greenway, Ark. (Dr. Meek); Johnson's Fork of the Llano, Wichita River and San Diego (E. D. Cope), Rio Seco (Dr. Kennerly) and Delaware Creek, Tex. (Capt. Pope); Detroit?, Mich. (E. D. Cope); James River at Marshfield, Mo. (Drs. C. H. Gilbert and S. E. Meek); Quincy, Ill.; Blue River, Ind. (E. D. Cope).

**Eupomotis holbroockii** (Valenciennes).

*Xystroplites longimanus* Cope, Proc. Amer. Philos. Soc. Phila., XVII, 1877-78, p. 67. Cotypes, Nos. 30,918 to 30,920, A. N. S. P. Volusia. Florida. E. D. Cope.

Dr. Jordan examined *Pomotis holbroockii* Valenciennes in the Paris Museum, and expressed the opinion that it is identical with *P. speciosus* Holbrook. As the original account of the former is imperfect I accept this view provisionally. The differences between Holbrook's figure and the examples before me are certainly not specific. The pectoral of the former is but little shorter than the head. The specific name is here adopted from the original.

**Eupomotis gibbosus** (Linnaeus).

Mount Desert, Me. (Dr. H. C. Chapman); Lake George, N. Y. (W. S. Vaux); Sandusky, O. (Smiths. Inst.); Michigan (E. D. Cope); lower James River, Va. (E. D. Cope); Catawba, French Broad and Yadkin Rivers, N. C. (E. D. Cope).

**Micropterus dolomieu** Lacépède.

Lake George, N. Y. (W. S. Vaux); Roanoke River, Va. (E. D. Cope); Fort Smith, Ark.; Wheatland and Davenport (Dr. S. E. Meek), and Brook River, Ia. (E. D. Cope); Miami River, Ind. (E. D. Cope); French Broad River, N. C. (E. D. Cope); Coal Creek, Tenn. (E. D. Cope); Fort Worth and Fort Johnson, Tex. (E. D. Cope).

**Micropterus salmoides** (Lacépède).

Lake Erie (Smiths. Inst.); Dr. J. Cheston Morris; Michigan (E. D. Cope); Davenport, Ia. (Dr. S. E. Meek); Nickajack Cave and Wabash River, Ind. (E. D. Cope); Norfolk (Smiths. Inst.) and lower James River, Va. (E. D. Cope); Yadkin, Catawba and French Broad Rivers, N. C. (E. D. Cope); Coal Creek in Clinch basin, Tenn. (E. D. Cope); South Carolina (Dr. Blanding); Bayport, Fla. (E. D. Cope); Indianola to Neuces, Tex. (Capt. Pope).

**PERCIDÆ.****Centropomus lucioperca** (Linnaeus).

Northern Europe (Bonaparte Coll.). The type of *Centropomus* Lacépède is the present species, therefore the American robalos become *Oxylabrax*, with the family name *Oxylabracidæ*.

**Stizostedion vitreum** (Mitchill).

Michigan (E. D. Cope); French Broad River, N. C. (E. D. Cope).

**Stizostedion canadense** (Griffiths).

North America (Bonaparte Coll.); Lake Erie (Dr. Watson).

*Stizostedion canadense boreum* (Girard).

Battle Creek, Ia. (E. D. Cope).

*Percia fluviatilis* Linnaeus.

Italy (Bonaparte Coll.); Sweden (Prof. J. Kinberg).

*Percia flavescens* (Linnaeus).

Mount Desert, Me. (Dr. H. C. Chapman); Martha's Vineyard, Mass. (Dr. J. H. Slack); Lake George, N. Y. (W. S. Vaux); Cold Pond, near Charlestown, N. H. (Dr. Weber); Sparrow Lake, Ontario (C. P. Ray); Sandusky, O. (Smiths. Inst.); Clear Lake, Ia. (Dr. S. E. Meek); Lake Whittlesey, Minn. (Dr. J. H. Slack); Lake Erie (Dr. Watson); Potomac River (Smiths. Inst.); Chestertown (E. G. Vanatta), and North East, in Cecil county, Md. (H. W. Fowler).

*Percina caprodes* (Rafinesque).

*Percia (Percina) nebulosa* Haldeman, Journ. Acad. Nat. Sci. Phila., 1842, p. 330. Type, No. 22,652, A. N. S. P. The Susquehanna. S. S. Haldeman.

North America (Bonaparte Coll.); Holston River, Va. (E. D. Cope); South Fork of Cumberland River, Tenn. (E. D. Cope); Miami and Wabash Rivers, Ind. (E. D. Cope); Ohio (U. S. Nat. Mus.); Fort Smith, Ark. (Drs. D. S. Jordan and C. H. Gilbert); Marshfield and Carthage, Mo. (Drs. Gilbert and S. E. Meek); Dallas, Tex. (E. D. Cope).

*Percina caprodes zebra* (Agassiz).

Sparrow Lake, in Simcoe county, Ontario (C. P. Ray).

*Hadropterus phoxocephalus* (Nelson).

Clinton, Mo. (Drs. D. S. Jordan and S. E. Meek).

*Hadropterus macrocephalus* (Cope).

*Etheostoma macrocephalum* Cope, Trans. Amer. Philos. Soc. Phila., (2) XIII, 1869, p. 400. Cotypes, Nos. 22,626 and 22,628, A. N. S. P. Youghioheny River in Western Pennsylvania. E. D. Cope.

*Hadropterus aspro* (Jordan).

Giles county and Walker's Creek, Va. (E. D. Cope); Miami River, Ind. (E. D. Cope); Hicksville, O. (Dr. S. E. Meek).

*Hadropterus peltatus* (Cope).

*Etheostoma peltatum* Stauffer, in Cope, Proc. Acad. Nat. Sci. Phila., 1864, p. 233. Type, No. 22,627, A. N. S. P. The Conestoga. Jacob Stauffer.

Buck Creek, N. C. (E. D. Cope).

*Hypohomus aurantiacus* (Cope).

*Cottogaster aurantiacus* Cope, Journ. Acad. Nat. Sci. Phila., (2) VI, 1869, p. 211, Pl. 24, fig. 6. Cotypes, Nos. 13,789 (type) and 13,790, A. N. S. P. Holston River, Virginia [according to label]. E. D. Cope.

*Cottogaster shumardi* (Girard).

Indiana (Dr. D. S. Jordan); Michigan (Prof. M. Miles).

*Ulocentra stigmæa* (Jordan). Fig. 5.

*Boleosoma stigmæum* Jordan, Ann. Lyc. Nat. Hist. N. Y., 1876, p. 311.  
Cotypes, Nos. 20,645 to 20,648, A. N. S. P. Etowah River, Georgia. D. S. Jordan.

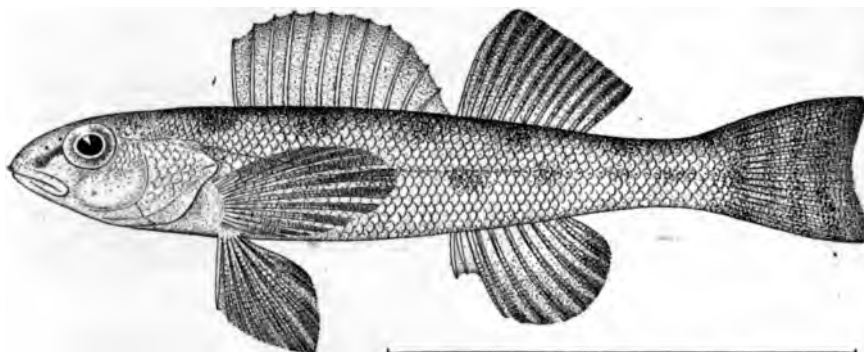


Fig. 5.—*Ulocentra stigmæa* (Jordan). (Cotype of *Boleosoma stigmæum* Jordan.)

*Diplesion blennioides* (Rafinesque).

*Pileoma cymatogramma* Abbott, Proc. Acad. Nat. Sci. Phila., 1860, p. 327.

Type, No. 14,009, A. N. S. P. Without locality.

*Hyostoma blennioperca* Cope, Journ. Acad. Nat. Sci. Phila., (2) VI, 1869, pp. 214, 215. Cotypes, Nos. 14,004, 14,006 to 14,008, 14,020 to 14,025 and 14,026 (type) to 14,035, A. N. S. P. Tributaries of the Kanawha and Holston. E. D. Cope. The type as here restricted is evidently the largest in the collection and is from the Holston.

Black River, O. (U. S. Nat. Mus.); South Fork of Cumberland and Clinch Rivers, Tenn. (E. D. Cope); Miami and Richmond, Ind. (E. D. Cope); French Broad River, N. C. (E. D. Cope); Joliet, Ill. (J. H. Ferris).

*Boleosoma nigrum* (Rafinesque).

*Boleosoma olmstedii* var. *brevipinnis* Cope, Journ. Acad. Nat. Sci. Phila., 1868, p. 214. Cotypes, Nos. 25,563 (type) to 22,567, A. N. S. P. Kiskiminitas River, Penna. E. D. Cope. In Proc. Amer. Philos. Soc. Phila., XI, 1871, p. 270, Cope raises this to the rank of a full species.

Hicksville, O. (Dr. S. E. Meek); Wabash River and Richmond, Ind. (E. D. Cope); Sinking Creek and Holston River, Va. (E. D. Cope); St. Josephs and Grosse Isle, Mich. (E. D. Cope); Marshfield, Carthage and James River, Mo. (Drs. C. H. Gilbert and S. E. Meek); Belmond and Anamosa (Dr. Meek), and Chariton, Ia. (Drs. D. S. Jordan and S. E. Meek); Platte River at Fort Kearney, Neb.; Big Creek at Fort Hayes, Kan.

*Boleosoma nigrum olmstedii* (Storer).

*Perca minima* Haldeman, Journ. Acad. Nat. Sci. Phila., VIII, 1842, p. 330.

Type, No. 13,928, A. N. S. P. (A dried skin poorly preserved.) The Susquehanna. S. S. Haldeman.

I am unable to distinguish Potomac River examples (Dr. Pickering) as *Arlina effulgens* Girard.

Patapsco River at Baltimore (H. W. Fowler); Elk Creek (A. H. Grosh and H. W. Fowler) and Stony Creek, in Cecil county, Md. (T. D. Keim and H. W. Fowler); Sussex county, Del. (E. D. Cope); lower Delaware River (Dr. C. Arrott).

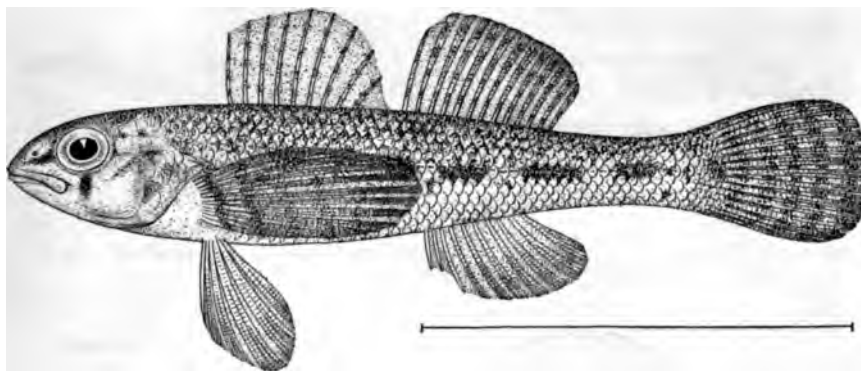


Fig. 6.—*Boleosoma nigrum maculaticeps* (Cope). (Type of *Boleosoma maculaticeps* Cope.)

*Boleosoma nigrum maculaticeps* (Cope). Fig. 6.

*Boleosoma maculaticeps* Cope, Proc. Amer. Philos. Soc. Phila., XI, 1871 (January 7, 1870), p. 269. Cotypes, No. 13,862 (type) to 13,876, A. N. S. P. Upper waters of the Catawba River, N. Carolina. E. D. Cope.

Also an example from the Yadkin River, N. C. E. D. Cope.

*Boleosoma effulgens* Cope, *l.c.*, p. 268, although considered distinct by Cope, does not show any very striking points of difference according to this account. Perhaps 6 scales below the lateral line is reliable.

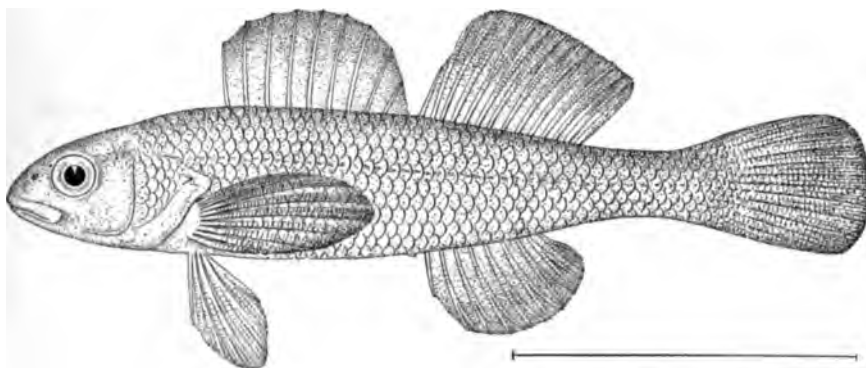


Fig. 7.—*Boleosoma nigrum mesæum* (Cope). (Type of *Pæcilichthys mesæus* Cope.)

*Boleosoma nigrum mesæum* (Cope). Fig. 7.

*Pæcilichthys mesæus* Cope, Proc. Acad. Nat. Sci. Phila., 1864, p. 232. Type,

No. 13,943, A. N. S. P. Platte River, near Fort Kearney, Neb. Dr. Hammond.

Cross-bars on dorsal and caudal indistinct and faded.

*Boleosoma camurum* Forbes.

Angelina River, Tex. (U. S. F. C.).

*Crystallaria asprella* (Jordan).

South Fork Cumberland River, Tenn. (E. D. Cope); Grosse Isle, Mich. (E. D. Cope).

*Ammoerypta pellucida* (Agassiz).

Indiana (D. S. Jordan).

*Etheostoma zonale* (Cope). Fig. 8.

*Pacilichthys zonalis* Cope, Journ. Acad. Nat. Sci. Phila., (2) XII, 1866-69 (December, 1868), p. 212. Cotypes, Nos. 14,036 (type) to 14,038, A. N. S. P. Holston River, Va. E. D. Cope.

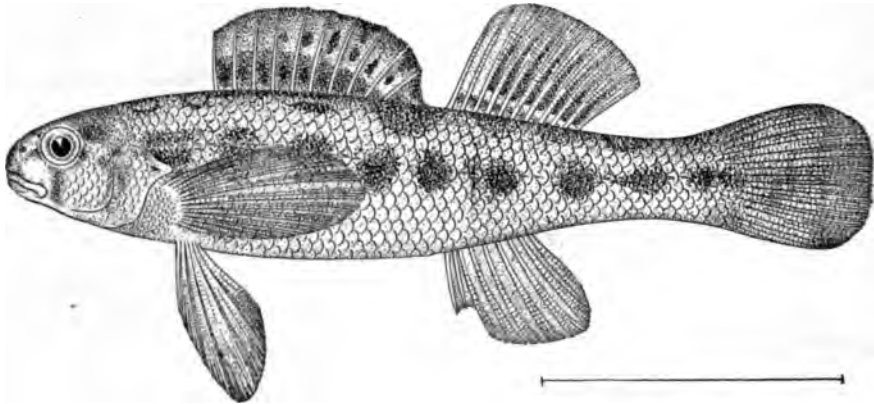


Fig. 8.—*Etheostoma zonale* (Cope). (Type of *Pacilichthys zonalis* Cope.)

Also many other examples from the above locality and the French Broad River, N. C. (E. D. Cope).

*Etheostoma maculatum* (Kirtland).

*Pacilichthys sanguifluus* Cope, Proc. Amer. Philos. Soc. Phila., XI, 1869-70 (January 7, 1870), p. 264. Cotypes, Nos. 13,738 (type) to 13,744, A. N. S. P. South Fork of Cumberland River, Tennessee. E. D. Cope.

*Etheostoma rufilineatum* (Cope). Fig. 9.

*Pacilichthys rufilineatus* Cope, Proc. Amer. Philos. Soc. Phila., XI, 1869-70 (January 7, 1870), p. 267. Cotypes, Nos. 13,791 (type) to 13,798, A. N. S. P. Warm Springs Creek, which flows into the French Broad River, in Madison county, North Carolina. E. D. Cope.

*Etheostoma jessie* (Jordan).

Etowah River, Ga. (D. S. Jordan).

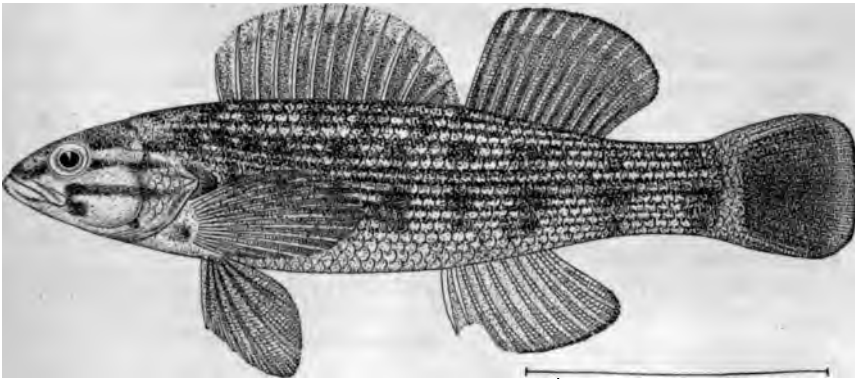


Fig. 9.—*Etheostoma ruflineatum* (Cope). (Type of *Pacilichthys ruflineatus* Cope.)

***Etheostoma oeruleum* Storer.**

*Pacilosoma transversum* Abbott, Proc. Acad. Nat. Sci. Phila., 1860, p. 826.  
Cotypes, Nos. 13,810 (type) to 13,819, A. N. S. P. Lake Superior.

Richmond, Ind. (E. D. Cope); Big Creek at Fort Hayes, Kan. (J. Janeway); South Fork Cumberland River, Tenn. (E. D. Cope); Ann Arbor, Mich.

***Etheostoma oeruleum spectabile* (Agassiz).**

Marshfield, Mo. (Drs. C. H. Gilbert and S. E. Meek); Sedalia, Mo. (Drs. D. S. Jordan and S. E. Meek).

***Etheostoma oeruleum lepidum* (Baird and Girard).**

*Boleosoma phlox* Cope, Bull. U. S. Nat. Mus., No. 17, 1880, p. 30. Type, No. 20,447, A. N. S. P. Trinity River, near Fort Worth. E. D. Cope.

Elmfork at Saint Joe, Montague county, Tex. (E. D. Cope).

***Etheostoma flabellare* Rafinesque.**

Sinking and Walker's Creeks, in Kanawha basin, Kanawha, Holston and Roanoke Rivers, Va. (E. D. Cope); Catawba River, N. C. (E. D. Cope); Richmond, Ind. (E. D. Cope); Grosse Isle, Mich. (E. D. Cope); Postville, Ia. (Dr. S. E. Meek).

***Boleichthys fusiformis erochreus* (Cope).**

Sussex county, Del. (E. D. Cope).

***Boleichthys fusiformis gracilis* (Girard).**

Palestine, Tex. (E. D. Cope).

***Boleichthys fusiformis palustris* (Gilbert).**

Indiana (E. D. Cope).

*Microperca punctulata* Putnam.

Indiana (E. D. Cope).

*Asperulus asper* (Linnaeus).

Rhone River, France (Bonaparte Coll.).

*Asperulus* Klein, in Walbaum, *Pet. Arted. Gen. Pisc.*, 1792, p. 584 (type *Perca zingel* Linnaeus only species mentioned), has priority over *Zingel* Cloquet, *Dict. Sci. Nat.*, IX, 1817, p. 240 (type *Perca zingel* Linnaeus first species).

*Asperulus zingel* (Linnaeus).

Danube River (Bonaparte Coll.), and also evidently those from E. D. Cope.

*Acerina cernua* (Linnaeus).

Sweden (Prof. J. Kinberg); Europe (Bonaparte Coll.).

*Gymnocephalus schraetser* (Linnaeus).

Danube?, Europe (Bonaparte Coll.).

#### APOGONIDÆ.

*Foa brachygramma* (Jenkins).

Hawaiian Islands (Dr. J. K. Townsend; Dr. William H. Jones).

*Apogon imberbis* (Linnaeus).

The example recorded by Cope from Newport, R. I., as *Apogonichthys americanus* differs a little from Mediterranean examples in the Bonaparte Coll. in having a shorter pectoral, though this may be associated with youth as it only measures  $3\frac{1}{2}$  inches. In this respect however it approaches Castelnau's figure, which was based on an example nearly 4 inches long, equal in size to my Mediterranean ones. The Newport specimen shows: Head  $2\frac{1}{2}$ ; depth  $2\frac{1}{2}$ ; snout  $4\frac{1}{2}$  in head; eye 3; maxillary 2; interorbital space  $4\frac{1}{2}$ ; pectoral  $1\frac{1}{2}$ ; maxillary reaching posterior margin of pupil; margin of preopercle with minute obsolete serræ; gill-rakers II, 2+9, III, and longest about  $\frac{2}{3}$  of eye; dark brownish dustings behind eye and on opercle above; a brownish blotch about as large as pupil on caudal peduncle at base of caudal; edges of rayed dorsal and upper and lower edges of caudal tinted dusky.

This and the following are members of the subgenus *Apogon*, distinguished by the presence of VI spines in the first dorsal, and the anterior ridge of the preopercle entire.

*Apogon retrosella* (Gill).

An example from J. A. McNeil, taken at Panama, from which locality the species has not been obtained before. It has a deep brown saddle on back at base of rayed dorsal, and another larger and obscure one



on the caudal peduncle posteriorly. Also a few dusky dots on post-ocular region. Opercle silvery.

*Apogon maculiferus* Garrett.

Two examples from the Hawaiian Islands. Coll. Dr. J. K. Townsend.

This species belongs to subgenus *Ostorhinchus* Lacépède, distinguished from the previous subgenus chiefly by the presence of VII spines in the first dorsal. Other species which I have examined are Sumatran examples of *A. evanidus* Fowler, *A. hyalosoma* Bleeker and *A. novemfasciatus* Cuvier, Japanese examples of *A. notatus* (Houttuyn), *A. lineatus* Schlegel, *A. semilineatus* Schlegel and *A. niger* Steindachner. *A. snyderi* Jordan and Evermann and *A. mensesemus* Jenkins from the Hawaiian Islands belong to subgenus *Pristiapogon* Klunzinger, distinguished by having both preopercular ridges serrate.

ASTRAPOGON subgen. nov.

Type *Apogonichthys stellatus* Cope.

Distinguished from subgenus *Apogonichthys* Bleeker, *Nat. Tijds. Ned. Ind.*, VII, 1854, pp. 312, 321 (type *Apogonichthys perdix* Bleeker), by the long ventrals, which reach well beyond the front of the anal.

(*'Αστρον*, star; *ἀ*, without; *πυ'ων*, beard.)

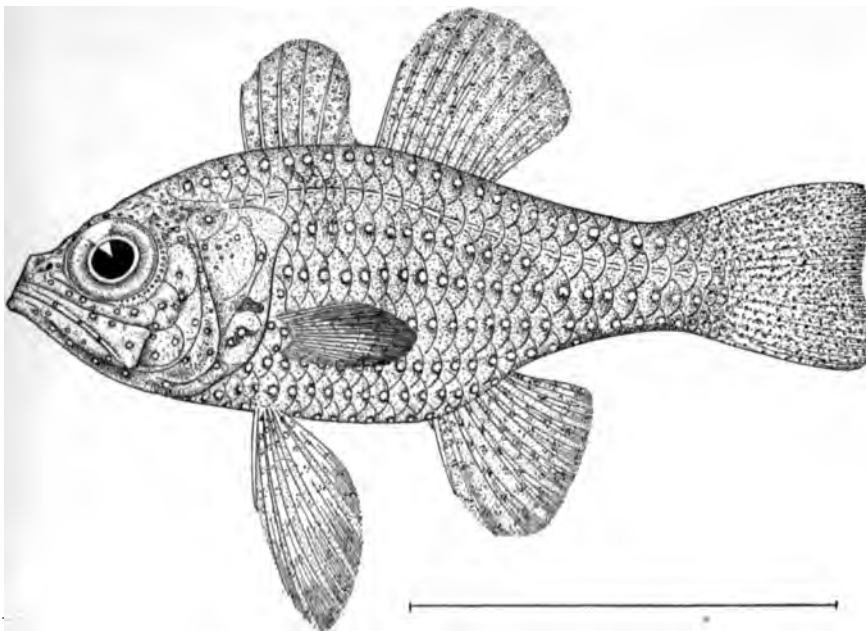


Fig 10.—*Apogonichthys stellatus* Cope. (Type.)

*Apegonichthys stellatus* Cope. Fig. 10.

*Tr. Amer. Philos. Soc. Phila.*, (2) XIII, 1866, p. 400. Nos. 12,677 (type) and 12,678, A. N. S. P., cotypes. New Providence, Bahamas. Dr. H. C. Wood.

The larger example may be selected as the type. It has interorbital space  $4\frac{1}{2}$  in head, and flattened. Gill-rakers II, 2+9, II, slender and longest  $\frac{3}{4}$  of eye. Length 2 inches.

Both have D. VI.

#### AMBASSIDÆ.

*Ambassis ranga* (Hamilton).

Three examples from India. Dr. M. Burrough.

I have also examined *Scombrops boops* (Houttuyn) from Japan.

## MOLLUSCA OF THE OZARKIAN FAUNA.

BY H. A. PILSBRY AND JAMES H. FERRISS.

In the midst of the valley of the greatest river of the continent the Ozark Mountains stand above the plain. On the east and south they are bordered by lowlands scarcely a hundred feet above sea level, and westward the great plains stretch to the foothills of the Rockies. The Ozarks rise to no considerable height, the highest point, Magazine Mountain, in Logan Co., Ark., attaining to 2,823 feet; but the rough topography, in strong contrast with that of surrounding regions, affords conditions favoring the evolution of special forms, species or races, adapted to these conditions. Many of these forms have probably been evolved just where we now find them, and where they are in a measure isolated by the absence or rarity of similar haunts in the lower and more level country surrounding the mountainous area.

Some aquatic forms, *Unionidæ* and *Pleuroceratidæ*, are also peculiar to the Ozark region, though in the main Mississippian species rule.

During the greater part of March and April, 1903, the authors collected at numerous places in the western Ozarks, in southwestern Missouri, western Arkansas, and Indian Territory, the localities selected being supplemental to those worked by Mr. Ferriss in 1900 and 1901. The results of our work are herein dealt with.

## I. FAUNAL RELATIONS OF THE OZARK REGION.

The Alleghanian (= Transition of Merriam), Carolinian (= humid Upper Austral) and Austroriparian (= humid Lower Austral) zones as mapped by Dr. Merriam,<sup>1</sup> in eastern North America, are probably reflected as clearly in land molluscan distribution as in that of vertebrates and plants, though of course there is broad overlapping of faunas, and the smaller details of the zonal limits remain to be determined by diligent local work. In the Northern States, this local amplification may well be based upon Dr. Merriam's map; but in the Southern Appalachian system some significant discrepancies appear when the land mollusks are compared with vertebrate distribution.

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<sup>1</sup> Life Zones and Crop Zones of the United States, *Bulletin* No. 10, U. S. Department of Agriculture, Division of Biological Survey, 1898.

The Boreal (Canadian) areas mapped by Merriam in Kentucky, Tennessee and North Carolina have for mollusca no faunal connection with or resemblance to the Canadian zone fauna of the northern mountains and Canada. There is no evidence that the northern fauna invaded these heights during the Ice Age, but much evidence to the contrary.<sup>2</sup> Had such an incursion taken place, it seems hardly conceivable that no *Vitrina*, *Pupilla*, *Vertigo* or northern *Zonitidæ* should remain to tell the tale. A certain ill-defined zonal distribution dependent on elevation may be traced, the mountain tops having a poorer fauna than the lower levels, with dwarfed races of some species and a few special species; but the zoological affinities of the forms are in the main with those of the lower coves, not with snails of higher latitudes.

This illustrates what has been recognized by a few zoologists working in other departments, that transcontinental "life-zones" have no necessary connection with the larger facts of faunal distribution, but define secondary divisions, parallel, so to speak, all over the world. For instance equal zones in the southern Alleghanies and the Rocky Mountains might be spoken of as "physically homologous," but not faunally so.

In eastern North America we have, leaving the Floridian tropical element out of the account, two faunas of inland mollusca, developed in diverse areas: (1) the Boreal fauna, consisting of Holarctic species or genera, such as *Vitrina*, *Zonitoides*, *Enconulus*, *Acanthinula*, *Valonia*, *Pupilla*, *Punctum*, *Sphyradium*, *Lymnæa*, etc., which apparently had their rise in the north, and (2) the Appalachian fauna, consisting of forms characteristic of the eastern United States, such as the *Mesodon*, *Triodopsis* and *Stenotrema* groups, *Omphalina*, *Vitrinizonites*, *Paravitrea*, *Gastrodonta*, the *alternata* group of *Pyramidula*, *Helicodiscus*, etc. From what we know of the Pliocene land shells, and those of the interglacial and post-glacial Loess, it is clear that these faunas must have been already as distinct at the close of the Pliocene as at present; and in the case of the Appalachian fauna, we have every reason to believe that its ancestors occupied eastern North America during tertiary time, and how much farther back no man can say.<sup>3</sup>

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<sup>2</sup> See in this connection, Pilsbry, Mollusca of the Great Smoky Mountains, *Proc. A. N. S. Phila.*, 1900, pp. 110-150, and Walker and Pilsbry, Mollusca of the Mt. Mitchell Region, *Proc. A. N. S. Phila.*, 1902, pp. 413-442.

<sup>3</sup> The boreal and southern elements in the east American fauna were fully recognized by Mr. W. G. Binney many years ago. Cf. also Charles C. Adams, Southeastern United States as a centre of geographical distribution of flora and fauna, *Biological Bulletin* III, pp. 115-131, 1902.

From the investigations made by the authors and their friends, it is obvious that there was in the East no extensive glacial recession of the snail fauna southward beyond the border of the ice sheet. It seems likely that the northern fauna of Appalachian origin was largely wiped out, and the survivors crowded with the boreal forms in a band along the States bordering the glaciated area. This comparatively recent concentration of the snail population southward gives at first the impression that the radiation of this element of our fauna was from the southeast, yet during the mild tertiary period favorable conditions certainly existed much farther north than at present, and there seems no more reason to postulate a southeastern than a north-eastern tertiary radiation.

In the more elevated Rocky Mountain region there was obviously a more extensive glacial recession. Boreal genera and species were pushed at least as far as the Mexican boundary, where they still survive at considerable altitudes.

The Appalachian types of land snails now extend over all of the Alleghanian, Carolinian and Austroriparian zones; but within this area we must recognize several strongly individualized faunas characterizing mountainous tracts. These are as follows:

I. The *Austro-Appalachian fauna*, comprising the eastern division of the Appalachian Mountains east of the valley of East Tennessee chiefly in North Carolina, south to Georgia. It is bounded on the north in Virginia and West Virginia by an Alleghanian zone fauna on the highest ridges and a normal Carolinian at lower levels. The Austro-Appalachian fauna has been explored by Dr. Rugel, Mrs. George Andrews, Mr. Wetherby, Messrs. Walker, Sargent, Clapp, and the present authors. It is mapped as Transition and Boreal in Dr. Merriam's Life Zone map of 1897.

II. The *Cumberlandian fauna*, including the western division of the Appalachian Mountain system in Kentucky, Tennessee and northern Alabama. The limits of this fauna extend southwestward beyond the nucleus plotted as Transition in Merriam's map. Our knowledge of this fauna is due to Lea, Binney, Bland, Wetherby, Harper and others. It has been neglected by the present generation of conchologists, but careful collections by Mr. and Mrs. H. H. Smith are now in progress on its southern border (Alabama).

III. The *Ozarkian fauna*, limited to the Ozark uplift, chiefly in Arkansas, but extending into adjacent States north and west. It is largely mapped as humid Upper Austral (= Carolinian) by Merriam.

These three faunas possess but few species in common, aside from

those widespread forms of the whole Carolinian zone, yet they have a similar facies, owing to the rich development of *Stenotrema* and toothed *Zonitidae*, the relative scarcity of *Pupillidae*, etc. It may be that the resemblances are due to parallelism in evolution of the faunas from a common source, yet the possibility may be entertained that the Mississippi embayment, which isolates the Ozark uplift, was crossed by a ridge, permitting rock-living snails to emigrate west from the Cumberland plateau, at some period in tertiary time. This is a geological question aside from our present purpose.<sup>4</sup> There is no mentionable trace of Boreal zone elements in any of the three southern mountain faunas; and no ground exists in the molluscan fauna for mapping even the highest peaks as Canadian or Alleghanian.

The Ozarkian fauna is thus one of several mountain faunas of common origin, all traceable to the Appalachian tertiary radiation. The limits of this fauna can be mapped only after much more field investigation, but roughly it includes the broken country of southern Missouri, a small area in southeastern Kansas, the hilly eastern part of Indian Territory, and the greater part of Arkansas, east as far possibly as the 500-foot contour line; but data are absolutely lacking for the definition of its eastern boundary in Arkansas. We know that on the opposite shore of the Mississippi there is no trace of Ozarkian forms. Possibly the upland region of northwestern Louisiana should be added.

On the northwest, north, and northeast of the Ozark area the widespread Carolinian species rule; on the southeast and south the Austroriparian, and on the southwest the uttermost waves of Lower Sonoran life ripple against the rising Ozark mass. The several elements of the fauna are here listed.

1. *Species and subspecies confined to the Ozark fauna:*

<i>Polygyra dorfeuilliana</i> . <sup>5</sup>	<i>Polygyra j. deltoidea</i> .
<i>d. sampsoni</i> .	<i>j. simpsoni</i> .
<i>d. percostata</i> .	<i>labrosa</i> .
<i>d. perstriata</i> .	<i>fraterna imperforata</i> .
<i>jacksoni</i> .	<i>pilsbryi</i> .

<sup>4</sup> Dr. D. S. Jordan writes: "Streams of the Ozark Mountains similar in character to the rivers of East Tennessee have an essentially similar fish fauna, although between the Ozarks and the Cumberland range lies an area of lowland bayous into which such fishes are never known to penetrate." (*Science Sketches*). He suggests that the time of mingling across the lowlands may have been when the intervening region had a colder climate.

<sup>5</sup> This species spreads southward as far as Galveston, etc., but it is listed here because it is an abundant Ozarkian form, and has three races confined to that area.

<i>Polygyra uncifera.</i>	<i>Polygyra indianorum.</i>
<i>blandiana.</i>	<i>i. lioderma.</i>
<i>inflecta media.</i>	<i>binneyana.</i>
<i>edentata.</i>	<i>b. chastatensis.</i>
<i>e. magazinensis.</i>	<i>kiowaensis.</i>
<i>obstricta occidentalis.</i>	<i>Gastrodonta demissa brittsi.</i>
<i>neglecta.</i>	<i>Omphalina fuliginosa ozarkensis.</i>
<i>cragini.</i>	<i>Vitrea aulacogyra.</i>
<i>exoleta ozarkensis.</i>	<i>significans.</i>
<i>divesta.</i>	<i>simpsoni.</i>

2. *Carolinian species occurring in the Ozark uplift or on its borders* (many of them extending also into the Austroriparian or Sonoran, the latter marked S.):

<i>Polygyra stenotrema.</i>	<i>Euconulus chersinus dentatus.</i>
<i>fraterna.</i>	<i>Agriolimax campestris</i> (S.).
<i>appressa.</i>	<i>Pyramidula solitaria.</i>
<i>a. perigrapta.</i>	<i>alternata.</i>
<i>inflecta.</i>	<i>perspectiva.</i>
<i>elevata.</i>	<i>Helicodiscus parallelus.</i>
<i>albolabris alleni.</i>	<i>Philomycus carolinensis.</i>
<i>thyroides.</i>	<i>Pupoides marginatus</i> (S.).
<i>clausa.</i>	<i>Bifidaria armifera</i> (S.).
<i>Circinaria concava.</i>	<i>contracta</i> (S.).
<i>Omphalina fuliginosa.</i>	<i>procera</i> (S.).
<i>friabilis.</i>	<i>pentodon</i> Say (S.).
<i>Gastrodonta ligera.</i>	<i>tappaniana</i> Ad. (S.).
<i>Zonitoides arborea</i> (S.).	<i>Cochlicopa lubrica</i> . <sup>6</sup>
<i>minuscule</i> (S.).	<i>Vallonia parvula.</i>
<i>Vitrea hammonis</i> . <sup>6</sup>	<i>Succinea retusa.</i>
<i>indentata</i> (S.).	<i>ovalis</i> Say.
<i>petrophila.</i>	<i>grosvenori</i> (S.).
<i>multidentata.</i>	<i>avara</i> (S.).

3. *Austroriparian and Sonoran species* (the latter marked S.), extending into the Ozark uplift or to its borders.

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<sup>6</sup> These are more properly Boreal species, extending downward, however, through and below the Alleghanian (Transition) zone.

<i>Helicina orbiculata tropica</i> (S.).	<i>Bulimulus dealbatus</i> .
<i>Polygyra texasiana</i> (S.).	<i>Zonitoides singleyana</i> .
<i>triodontoides</i> .	<i>Euconulus chersinus trochulus</i> (S.).
<i>leporina</i> .	<i>Vertigo rugosula</i> .
<i>fraterna</i> .	<i>Strobilops labyrinthicus texasianus</i>
<i>f. friersoni</i> .	(S.)
<i>f. aliciae</i> .	<i>Helicina orbiculata tropica</i> 'Jan.'
	Pfr. (S.)

About 36 per cent. of the total number of land snails listed are thus peculiar to the Ozark fauna; but when its boundaries come to be more exactly defined, and the finger-like extensions of the Austroriparian and Sonoran areas along the river bottoms are eliminated, the proportion of special forms will probably be increased.

## II. ANNOTATED LIST OF SPECIES.

With few exceptions, only the species collected by the authors in March and April, 1903, are treated of here. For a full knowledge of the Ozarkian fauna up to this time, Papers 6, 9 to 25 of the Bibliography appended must be consulted in connection with this.

The specimens reported below were collected by the authors, except when another collector's name is given in parenthesis. Unless otherwise stated, all records are from specimens, not from the literature.

*Helicina orbiculata tropica* 'Jan' Pfr.

Missouri: Chadwick, Christian Co.

Arkansas: Rogers, Benton Co.; Blue Mt. Station, Logan Co.

Indian Territory: Limestone Gap, Choctaw Nation; Wyandotte.

*Polygyra texasiana* (Moric.).

Oklahoma City, Okla. (Ferriss). A form with rather weak, irregularly developed striation, similar to the Texan transitions between *P. texasiana* and *P. t. hyperolia*. Also Petit Jean, Ark., and Limestone Gap, I. T. (Ferriss); found by Pilsbry at neither place.

Mr. Sampson reports this species from Sebastian and Nevada Cos. Ark., and from Indian Territory, opposite Fort Smith, Ark.

*Polygyra dorfeuilliana* Lea.<sup>7</sup> Pl. XX, figs. 13, 14, 15, 16.

This species is now known to us from the following localities:

<sup>7</sup> This species was named for Mr. Dorfeuille, of Cincinnati, proprietor of a museum and place of amusement known in 1827 as "Dorfeuille's Hell." Mrs. Trollope, in *Domestic Manners of the Americans*, states that "Cincinnati has not many lions to boast, but among them are two museums of natural history; both of these contain many respectable specimens, particularly that of Mr. Dorfeuille, who has moreover some highly interesting Indian antiquities. He is a man of taste and science. . . . As Mr. Dorfeuille cannot trust to his science for attracting the citizens, he has put his ingenuity into requisition . . . . He has constructed a pandemonium in an upper story of his museum, in which he has congregated all the images of horror that his fertile fancy could devise," etc.



*Missouri:* Warsaw, Benton Co.; Springfield, Green Co.; Chadwick, Christian Co.; Seligman, Barry Co.; Current River, county not recorded. Mr. Sampson adds Camden, Howell, Douglas, Macdonald and Jasper counties (*Nautilus*, VIII, pp. 18, 19). Baker records Arcadia, Iron Co., and J. H. Britts found it in Henry Co. (Walker Coll.).

*Kansas:* Arkansas City, Cowley Co.

*Arkansas:* Mammoth Spring, Fulton Co.; Hardy, Sharp Co.; Eureka Springs, Carroll Co.; Rogers, Benton Co.; Van Buren Co.; Chester and Porter, Crawford Co.; Carrion Crow Mt., near Atkins P. O., Pope Co.; Gwynn and Poteau Mts., Sebastian Co.; Blue Mt. Station, Magazine Mt. and Petit Jean Mt., Logan Co.; Hatton Gap, Rich Mt. and Mena and Cove, Polk Co.; Gilham, Chapel Hill, Horatio and Ultima Thule, Sevier Co.; Morris Ferry and Rocky Comfort, Little River Co.; Hot Springs, Garland Co. It has, in addition to these places, been recorded from Hempstead, Nevada, Washington, Franklin, Pulaski, Johnson and Perry counties by Mr. Sampson.

*Indian Territory:* Wyandotte, Wyandotte Nation; Fort Gibson, Cherokee Nation; Red Fork, Creek Co.; Eufaula, Sugar Loaf Mt., Wister, Poteau, Tushkahoma, Standley, Antlers and Limestone Gap, Choctaw Nation.

*Louisiana:* Frierson and Nachitoches, Nachitoches Co.; De Soto Co. (Coll. B. Walker); Mt. Lebanon, Bienville Co.

*Texas:* DeKalb, Bowie Co.; Cooke Co.;<sup>a</sup> Denison, Grayson Co.; Dallas, Waco; Tarrant Co.;<sup>b</sup> Washington Co.;<sup>b</sup> Burleson<sup>a</sup> and Brazos<sup>a</sup> counties; Galveston.

These places are plotted on the accompanying map, on which localities for *P. dorfeuilliana* are represented by dots and the variety *sampsoni* by outlined dots. Henry and Camden counties, Mo., are the most northern localities known, and Arcadia, Iron Co., Mo., and the Current River are the easternmost. On the west it is known from Grouse Creek, near Arkansas City, Kan., and throughout the eastern half of the Indian Territory, and in Cooke Co. and Fort Worth, Tex. Southward it penetrates to Washington Co., Tex., in the latitude of Austin.

This species thus inhabits an oblong area about 600 miles long and 300 wide. In Missouri and Arkansas it is not known from the Mississippi lowlands, all known localities being above the 500 feet contour. In Louisiana and Texas, however, it descends to half that elevation,

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<sup>a</sup> On the authority of Mr. J. A. Singley.

<sup>b</sup> On the authority of W. G. Binney.

but yet, except at Galveston, where it may be imported, it seems to be absent from the very wide and low Gulf border.

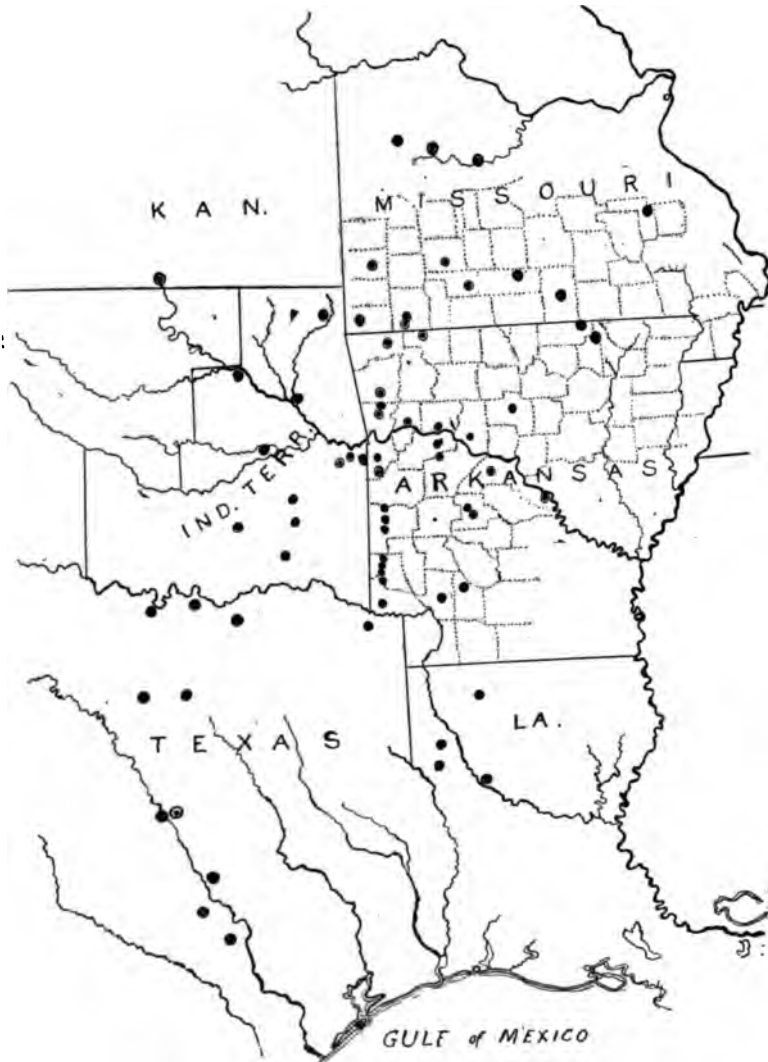


Fig. 1.—Distribution of *Polygyra dorfeuilliana* Lea, known localities represented by dots.

The variety *sampsoni* Wetherby, by its more uncoiled spiral, is a more evolved or accelerated race than typical *dorfeuilliana*. It occu-

pies the northern central portions of the area, while the less evolved typical form is peripheral. There is, however, no line to be drawn between them, as in many places both forms and the intergrades occur together, and in the Choctaw Nation especially, most specimens are intermediate in size of the umbilicus.

In 1903 we took the species at eleven localities in Missouri, Arkansas and Indian Territory. Some of the specimens from the bluff along Grand River at Wyandotte, near the northeast angle of Indian Territory, are the largest I have seen, and also the most extreme of the *sampsoni* form, diameter 8 to 9.3 mm. (Pl. XX, figs. 17, 18, 19). Those from Limestone Gap, Indian Territory, and Magazine Mt., Ark., are intermediate in characters. At Mammoth Spring, Fulton Co., northeast Arkansas, only typical *dorfeuilliana* was taken, the shells being small, 6.7 mm. diam. (Pl. XX, fig. 12). This is exactly the size given by Lea for the type, .3 inch.

In originally describing this species, Dr. Lea gave the locality as "Ohio, Mr. Dorfeuille, Cincinnati." Mr. W. G. Binney states that "Mr. J. G. Anthony obtained from Mr. Dorfeuille some facts concerning the original discovery of this species, which prove beyond all doubt that it was accidentally brought from Kentucky." It is on the strength of this that he reports it from "Kentucky, opposite Cincinnati." Binney also records *dorfeuilliana* from "Coosa River, Alabama."

A somewhat extensive correspondence with active collectors has failed to bring out any definite locality for *dorfeuilliana* in Kentucky, Tennessee or Alabama. Inquiry among Cincinnati conchologists has elicited no further confirmation of Mr. Dorfeuille's Kentucky record. Mr. Bryant Walker writes: "There are no *P. dorfeuilliana* from east of the Mississippi, so far as I can find, in the Wetherby collection. I have two specimens labelled 'Ky.' sent me years ago by Anthony, and one from the Lathrop collection from 'Wn. Tennessee.' "

Dr. W. H. Dall, of the U. S. National Museum, under date of October 21, 1905, writes: "I have looked over our series of *dorfeuilliana* Lea. One, marked by Lea 'type,' has the locality 'Cincinnati,' but the label records no collector's name, but the original description credits it to Dorfeuille. There is also a fragment from Florida named by Binney *dorfeuilliana*, but which in my opinion is a fragment of *avara*. The first is No. 116,779, the other 47,318. We do not have it from Alabama. All our series are from Indian Territory, Arkansas, Louisiana, Texas. I feel quite confident the Ohio or Kentucky locality is erroneous."

Mrs. George Andrews informs us that no specimens from east of the Mississippi have come to her knowledge aside from the records in Mr. Binney's work, already alluded to.

It is our experience that in the trans-Mississippian region where *P. dorfeuilliana* occurs it is a common snail, readily found in all suitable stations, and often in considerable quantity. It is not one of the snails occurring only in restricted localities and requiring special search to find. It seems therefore doubtful whether its range really extends east of the Mississippi at all; and until some definite cis-Mississippian locality for it is put on record, we are disposed to erase Ohio, Kentucky, Tennessee and Alabama from the ascertained range of the species.

The variety *percostata* Pils.<sup>10</sup> (Pl. XX, fig. 23) was based on specimens from the Red River in southwest Arkansas, in which the riblets of the upper surface continue over the base, which is strongly and coarsely rib-striate. The sculpture, however, varies a good deal, even in the original lot of several hundred specimens, most of which are as smooth as the ordinary form of *dorfeuilliana*. The umbilicus, while variable in width, is never so wide as in typical *sampsoni*. The diameter is from 7 to 9 mm.

We hesitate now to treat *P. d. percostata* as a subspecies, yet the tendency in this local race to produce a sculptured base is not present in a great number of other colonies of *dorfeuilliana* which have been studied in thousands of specimens.

*P. d. perstriata* n. subsp. Pl. XX, figs. 24 (type), 20, 21, 22.

Another incipient race of *P. dorfeuilliana* from Tushkahoma and Poteau, Indian Territory, is open below like *P. d. sampsoni*, but the base is finely and densely striate. In a large series collected the sculpture varies but little.

Other specimens from Mena, Ark. (Pl. XX, figs. 20-22) are smaller, and vary to forms with less distinctly striate base.

*Polygyra jacksoni* (Bland). Pl. XX, figs. 1-5.

The axis in this species is distinctly perforate at all stages of growth. The upper lip-tooth is deeply placed and very oblique. Viewed from the inside, the spire and parietal wall removed, it is seen to be a narrow oblique lamina. There is no tubercle on the columella inside, at least in the specimens I have opened. The diameter varies ordinarily from 6.5 to 7.5 mm.

The type locality is Fort Gibson, I. T. We collected it copiously in

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<sup>10</sup> *Polygyra dorfeuilliana percostata* Pils., Nautilus, XIII, p. 37. Type loc., near Texarkana, Ark., on the Red River.

the Petit Jean Mts., Logan Co., Ark. A few were taken at Blue Mountain Station, Logan Co., Ark.; and in Indian Territory, Wyandotte Nation, at Wyandotte, on the top of the bluff, in dry woods under stones. Some of them are very small, barely over 6 mm. diam. Specimens from Springfield, Mo., are also small, 6.6 to 7 mm. diam.

The localities now known for *P. jacksoni* follow:

*Southwestern Missouri*: Camden Co.;<sup>11</sup> Dade Co.;<sup>11</sup> Ash Grove and Springfield, Green Co.; Jasper Co.; Barry Co.;<sup>11</sup> Macdonald Co.<sup>11</sup>

*Arkansas*: Eureka Springs, Carroll Co.; Washington Co.;<sup>11</sup> Rogers, Benton Co.;<sup>12</sup> Porter and Chester, Crawford Co.; Van Buren Co.; Franklin Co.;<sup>11</sup> Sebastian Co.;<sup>11</sup> Blue Mt. Station and Petit Jean Mts., Logan Co.; Rich Mt. and Mena, Polk Co.<sup>12</sup>

*Indian Territory*: Wyandotte, Wyandotte Nation; Fort Gibson, Cherokee Nation; Poteau, Choctaw Nation.<sup>12</sup>

The range of the species eastward in northern Arkansas remains to be mapped. On the south its limit is apparently indicated with approximate accuracy, since the explorations of Mr. Ferriss in Arkansas south of Polk county, and of both of us in the adjacent portions of Indian Territory, failed to bring *P. jacksoni* to light.

*Polygyra jacksoni deltoidea* (Simpson). Pl. XX, figs. 6, 7.

*Helix* (*Polygyra*) *jacksoni* var. *deltoidea* Simps., Proc. U. S. Nat. Mus. 1888, p. 450.

Similar to *P. jacksoni*, except that the front edge of the parietal callous is very thick and raised in an erect triangle. Alt. 3.5, diam. 8 mm., or smaller, diam. 7.5 mm. This form has been found only near Fort Gibson, I. T. It has not before been illustrated. The figures are from cotypes.

*Polygyra jacksoni simpsoni* n. subsp. Pl. XX, figs. 8, 9, 10, 11.

Larger than *P. jacksoni* and wholly imperforate, though the axis is hollow except in the last whorl, and the young shells therefore are perforate. The aperture does not differ from that of *P. jacksoni*, but there is a small tubercle within on the columella, seen upon breaking into the base. Whorls 5½. Alt. 4.7, diam. 9.3 mm. The largest specimen taken measures 9.5 mm. diam., the smallest 8.3 mm.

The types were taken by us near Wyandotte, Wyandotte Nation, in the northeast angle of Indian Territory, on the south bank of Grand River, on a steep rocky bluff facing north. Mr. Simpson found this form near Fort Gibson, I. T., and it may be what Sampson refers to as

<sup>11</sup> Recorded on the authority of Mr. F. A. Sampson.

<sup>12</sup> Recorded on the authority of J. H. Ferriss.

a large form of *P. jacksoni* which he took on the bluffs of the Arkansas River at Van Buren, Crawford Co., and in Sebastian Co., Ark., but we have not seen his specimens.

At Wyandotte *P. j. simpsoni* alone is found on the bluff facing the river, while the small typical *jacksoni* occurs in the dry stony woodland at the summit of the bluff. In no case were the two forms found in company.

In 1900 Mr. Ferriss took a specimen of this variety at Mena, Polk Co., Ark. (cf. *Nautilus*, XIV, p. 28, No. 72).

#### Section *Stenotrema* Raf.

Five species of this group are now known from the Ozark region: *P. stenotrema*, *P. labrosa*, *P. blandiana*, *P. uncifera* and several subspecies of *P. fraterna*. The common Eastern *P. hirsuta* is not known to enter the Ozarks. Mr. Sampson has recorded it from Sedalia, Mo., a place well out of the Ozark fauna. *P. fraterna*, *P. fraterna friersoni* and *P. f. aliciae* are the only *Stenotremes* known to reach so far southwest as Texas.

#### *Polygyra stenotrema* ('Fér.' Pfr.).

Not a common snail in the Ozark region, so far as my experience goes. It does not appear in Mr. Singley's Texas list, and I can find no Missouri record, though from its presence at Hardy and Wyandotte it may reasonably be expected over the State lines northward in both Missouri and Kansas, as well as in the still unknown eastern part of Arkansas. The following localities are represented by specimens before us:

*Arkansas*: Hardy, Sharp Co. (Ferriss); Mabelvale, Pulaski Co. (C. W. Johnson); Petit Jean Mts., south of Hartford, Sebastian Co., one dead shell (Pilsbry and Ferriss); spur of the Chastat Mts., about 6 miles south of Mena, Polk Co. (Ferriss); to which Mr. Sampson adds the records Clark, Garland and Independence counties.

*Indian Territory*: Wyandotte, Wyandotte Nation (Pilsbry and Ferriss); Fort Gibson, in the Cherokee Nation (E. W. Hubbard). It was also taken at the latter place by C. T. Simpson in 1888.

#### *Polygyra labrosa* (Bland).

Proc. A. N. S. Phila., 1903, p. 202, pl. 9, figs. 4-6.

*Helix labrosa* Bld., Ann. Lyc. N. H. of N. Y., VII, 1862, p. 107, pl. 4, fig. 19.

In 1903 we took this species at eight places in Missouri, Arkansas and Indian Territory. It is quite abundant in most places, and varies but slightly. The recorded range of *P. labrosa* east of the Mississippi in Tennessee and Alabama (see Bland) rests solely upon data and speci-

mens furnished by our conchological forefathers, and no localities more definite than the States mentioned have been given. It may be that the eastern range claimed for this species and *Polygyra dorfeuilliana* will prove to be without foundation in fact. In the West its actually ascertained range is as follows. Except where otherwise stated, we have examined specimens from the localities mentioned:

*Missouri*: Camden, Benton, Macdonald and Jasper counties;<sup>13</sup> Springfield, Green Co.;<sup>13</sup> Marble Cave near Galena, Stone Co.; Seligman, Barry Co.; Chadwick, Christian Co.; Cedar Gap, Wright Co.<sup>14</sup>

*Arkansas*: Mammoth Spring, Fulton Co.; Eureka Springs, Carroll Co.; Rogers, Benton Co.; Van Buren<sup>13</sup> and Chester,<sup>14</sup> Crawford Co.; Washington,<sup>13</sup> Franklin,<sup>13</sup> Conway,<sup>13</sup> Perry,<sup>13</sup> and Independence<sup>13</sup> counties; Carrion Crow Mt.,<sup>14</sup> Pope Co.; Hot Springs, Garland Co.; Washita Springs,<sup>13</sup> Montgomery Co.; Little Rock, Pulaski Co.; Magazine Mt., from the summit down, and Petit Jean Mts., Logan Co.; Poteau Mts., south of Gwynn P. O., Hartford Sta., Sebastian Co.

*Indian Territory*: Sugar Loaf Mt., northwest of Gwynn P. O., Ark.

These localities are all in the hilly or mountainous country, chiefly in central and western Arkansas, barely reaching over the State border on the west, but extending some distance north into Missouri. Nowhere does the species approach the lowlands of the Mississippi, so far as we know at present; but we are still practically without data on the land molluscan fauna of eastern Arkansas.

In his original description Bland mentioned four localities for *P. labrosa*: Washita Springs and Hot Springs, Ark., Tennessee and Alabama. As neither was designated as typical, I would suggest that Hot Springs, Garland Co., Ark., be selected as the type locality. It has been collected there by Ferriss and others.

There is a *Helix labrosa* of Wood, *Index Testaceologicus*, Suppl., p. 24, pl. 8, fig. 69 (1828), which seems to be identical with *Buliminus labiosus* Müll.

*P. (Stenotrema) edgariana* might be supposed to inhabit Arkansas, from the range given by Binney, *Man. Amer. Land Shells*, p. 275, but it has not to my knowledge been found west of the Mississippi River, and I doubt its occurrence there.

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<sup>13</sup> Recorded from this locality on the authority of Mr. F. A. Sampson.

<sup>14</sup> Recorded from this locality on the authority of J. H. Ferriss.

<sup>15</sup> Recorded from this locality on the authority of Thomas Bland.

***Polygyra monodon* (Rack.).**

*Helix monodon* Rackett, Linnean Trans., XIII, 1822, p. 42, pl. 5, fig. 2.

*Stenotrema monodon* var. *leai* Ward, Binney, Man. Amer. Land Shells, p. 281, fig. 297.

*Polygyra monodon* Pils., Proc. A. N. S. Phila., 1900, p. 454.

The southern range of typical *P. monodon* (*Stenotrema leai* of authors) seems to barely reach the Ozark region. Mr. F. A. Sampson records it from Sedalia, Pettis Co., and Lamar, Barton Co., Mo., and Carroll, Benton, Washington and Nevada counties, Ark.; also Neosho Co., Kan. We have not ourselves seen Arkansas specimens. The following subspecies replace *P. monodon* in the Southwest.

***Polygyra fraterna friersoni* Pils.**

*Nautilus*, XIII, p. 36 (1899); Proc. A. N. S. Phila., 1900, pp. 454-456.

The shell is perforate or rarely closed, with  $6\frac{1}{2}$  whorls, a long fulcrum, much longer than in *P. f. imperforata*, and no distinct notch at the base of the columella. It is larger than *P. f. aliciae* with more whorls. Numerous localities are given in Pilsbry's paper of 1900, to which the following may be added: Fayette Co., Tex., and Nashville, Tenn., in an open field, collected by A. G. Wetherby. This is the only locality known east of the Mississippi River. The type locality is Frierson, La.

***Polygyra fraterna* (Say).**

It is somewhat peculiar that this form turns up in central Texas, where it was taken by us at and near New Braunfels, and by Pilsbry at Austin about 14 years ago.

***Polygyra fraterna imperforata* Pils.**

Proc. A. N. S. Phila., 1900, p. 455; 1903, p. 204.

We took this form on the Poteau Mts., south of Gwynn P. O. (Hartford Station), Sebastian Co., Ark. It is known also from Rich Mt. and Mena, Polk Co., and Rocky Comfort, Little River Co., Ark. One of the types from the last locality measures: alt. 7.7, diam. 10.5 mm. to alt. 6.7, diam. 9 mm.

***Polygyra fraterna aliciae* Pils.**

*Helix monodon* var. *aliciae* Pils., Man. Conch., VIII, p. 152. Feb. 25, 1893.

*Polygyra monodon aliciae* Pils., Proc. A. N. S. Phila., 1900, pp. 454-456; 1903, p. 204.

This form is typically small and elevated with very convex base, narrowly perforate axis, and  $5\frac{1}{2}$  to 6 whorls. The degree of elevation varies a good deal. The fulcrum is long and strongly notched above and below. The basal lip has a more or less strongly developed flange on its face, somewhat as in *P. vultuosa*, with a notch where it ends at the columella. Specimens of the type lot from Lake Charles, La., measure from 5 x 7 mm. to 5.7 x 7.8 mm.



We took this subspecies at the following localities: Monett, Barry Co., Mo.; Petit Jean Mts., Sebastian Co., Ark.; Wyandotte, Vinita, Wister, South McAlester and Limestone Gap, Indian Territory.

It is before us from three localities near the northeastern angle of Texas: Gainesville, Cass Co. (Ragsdale); Wood Co. (R. Walton Coll.); and DeKalb, Bowie Co. (Ferriss).

*Polygyra obstricta occidentalis* n. subsp. Pl. XXII, figs. 30, 31, 32.

Shell imperforate, slightly convex or nearly flat above, very convex beneath; similar to the more strongly carinate form of *P. o. carolinensis*, but differing by the reduced teeth, those of the lip being very small or vestigial. Surface rib-striate, very minutely and densely papillose between the riblets, not coarsely roughened as in *obstricta*. Whorls 4½ to nearly 5, the last slightly descending in front.

Alt. 7.7, diam. 18.7 mm.

Alt. 8.2, diam. 17.8 mm.

Alt. 7, diam. 17 mm.

Alt. 7.5, diam. 16.5 mm.

Northern Arkansas, probably from near Benton, Saline Co. Collected by Prof. Stuart Weller. Collections of Ferriss and A. N. S. Phila.

This form is readily distinguishable by its dwarf stature and much reduced lip-teeth. It is less acutely keeled than typical *P. obstricta*. It is evidently what Mr. Sampson<sup>18</sup> reports from Independence Co., Ark. He found one specimen 20.5 mm. in diameter.

*P. obstricta carolinensis* (Lea) extends westward in the South to Grand Cane, De Soto Co., La., where it was collected by Mr. George Williamson. Typical *P. obstricta* has not, I believe, been found west of the Mississippi River.

*Polygyra inflecta* (Say). Pl. XXII, fig. 1.

*Missouri*: Chadwick, Christian Co.

*Arkansas*: Rogers, Benton Co.; Blue Mountain Station and Magazine Mountain, both on the north and south sides of the summit, and Petit Jean Mts., Logan Co.; Poteau Mountain, south of Gwynn P. O. (Hartford Station), Sebastian Co.

*Indian Territory*: Wyandotte, along the Grand River, Wyandotte Nation; Sugar Loaf Mt., Wister and Limestone Gap, Choctaw Nation.

This common snail was everywhere found in abundance; and since in various places it has diverged to form local races or species, some account of its variation may be timely. The type locality given by Thomas Say is "lower Missouri"—that is, along the Missouri River

<sup>18</sup> Mollusca of Arkansas, 1893, p. 186

within the State of Missouri. The type specimen measures alt. 6.2, diam. 11.25 mm., with 5 whorls. The outer lip-tooth recedes a little and is somewhat broad and rounded. The lower or basal tooth is marginal, decidedly narrower than its fellow, and tubercular. The notch between the two teeth is squarish and decidedly wider than deep. See Pl. XXII, fig. 1.

In the stony ravines of the Ozark system at Chadwick, Mo., the extensive series collected shows two forms, which we will call 1 and 2, occurring in the proportion of 13 of form 1 to 38 of form 2, or one to three. Form 1 (Pl. XXII, figs. 2, 3) is nearly typical, but more frequently the outer tooth is as small as the basal. The size varies from 5.2 x 10 to 7.3 x 12 mm. Form 2 is more solid, with the aperture more contracted by larger teeth (Pl. XXII, figs. 4-6). The two lip-teeth are subequal, the basal one massive and broadly conic. The notch between them is narrower than in the type, and as deep as it is wide. No specimens reach the size of form No. 1, the extremes measuring 5 x 9 and 5.3 x 10 mm. Whether these two forms occurred together or in separate colonies was not noted.

The forms from other localities mentioned above vary from typical to a condition of teeth intermediate between the two forms described. Thus at Wyandotte, near the northeast angle of Indian Territory, intermediate specimens occur in profusion (Pl. XXII, figs. 7, 8). Among them was a mutation with the basal tooth obsolete, singularly like *P. smithi* Clapp, except in the smaller size, diam. 10.4 mm. (fig. 9).

On the northern side of the cliff defining the summit plateau of Magazine Mountain it occurs adjacent to the locality for *P. edentata magazinensis*, though not actually associated with it. The specimens here are mostly small, diam. 9.5 to 11.2 mm. On the drier and warm side south of the summit plateau and in the valley south of Blue Mountain Station, at the southern foot of the mountain, they are equally small. The largest *inflecta* we found were taken in the Petit Jean Mountains, about ten miles south of Magazine Mountain, where they measured 12.3 to 13.8 mm. diam., and usually have the basal lip calloused on the axial side of the basal tooth. The crest behind the lip is also sharp and high.

*Polygyra inflecta media* Pils. Pl. XXII, fig. 10.

Pilsbry, Proc. A. N. S. Phila., 1903, 197, in text.

Lip-teeth reduced to small tubercles, but still stronger than in *P. edentata*. Seligman, Barry Co., Mo. (Ferriss, 1901). Types No. 81 437 A. N. S. P., cotypes in Ferriss Coll.

This is a further development of *P. inflecta* form No. 1, described above.

*Polygyra edentata* (Sampson). Pl. XXII, figs. 11, 15, 16.

*Triodopsis edentata* Sampson, Nautilus, III, p. 85, December, 1889.

*Triodopsis edentula* Sampson, W. G. Binney, Third Supplement Terr. Moll., V, p. 190.

*Polygyra edentata* Sampson, Pils., Man. of Conch. VIII, p. 154, pl. 50, figs. 16-18; Proc. A. N. S. Phila., 1903, p. 197.

The original specimens came from the summit of the Boston Mts., at Winslow, Washington Co., Ark. Mr. Sampson found it also at Porter, Crawford Co., and Ferriss took specimens at Chester, in the same county. These localities afford specimens 12 to 14 mm. in diam.

*P. edentata* differs from *P. inflecta* by the reduction of the two lip-teeth to small and inconspicuous prominences, which however occupy the positions of the prominent teeth in *P. inflecta*. The specimens from Chester have a somewhat sharper, higher crest behind the lip than the others.

*Polygyra edentata magazinensis* n. subsp. Pl. XXII, figs. 12, 13, 14, 17, 18.

Similar to *P. edentata*, but more contracted behind the lip, and with the aperture less rounded, more triangular, the lower lip-tooth absent, replaced by a low, wide prominence nearer to the columellar end of the basal lip; scale-like cuticular processes well developed.

Alt.....	7	7	7	6.7	7	6	6 mm.
Diam.....	14	13.5	13.3	13	12.5	12	11.5 "

Most of the series of 114 specimens measure from 13 to 14 mm. diameter. All agree in the shape of the aperture and peristome, which varies remarkably little.

Magazine Mountain, Logan Co., Ark., in a talus of large rocks under the cliff on the north side of the summit plateau (Ferriss and Pilsbry March 28-30, 1903). We found a single dead specimen on the south side, near where the road ascends the cliff.

The smallest specimens are distinctly angular at the periphery in front.

*Polygyra cragini* (Call).

*Triodopsis cragini* Call, Bull. Washb. Coll. Lab. N. H., I, No. 7, p. 202, fig]5. December, 1886 (banks of Chetopa Creek, Neosho Co., Kansas).

This small *Triodopsis* varies but little so far as present collections indicate. It borders the Ozark elevation on the west, from Kansas to Texas and Louisiana, the localities known to us by specimens up to this time being as follows:

*Southeast Kansas*: Neosho Co. (Cragin); Thayer (Ferriss).

*Indian Territory*: Vinita, Cherokee Co. (Pilsbry and Ferriss); Red Fork, Creek Co. (Ferriss); McAlester (C. T. Simpson), South McAlester (Pilsbry and Ferriss) and Choctaw City (Ferriss), Choctaw Country.

*Western Arkansas*: Mena, Polk Co.; Ultima Thule, Sevier Co. (J. H. Ferriss); Rocky Comfort,<sup>17</sup> Little River Co.

*Northwestern Louisiana*: Frierson, Nachitoches Co. (L. S. Frierson).

*Northeastern Texas*: Wood Co. (J. A. Singley).

At South McAlester, I. T., we found it under stones and wood on a stony hillside, April 8, 1903.

*Polygyra hopetonensis* (Shuttlw.). There is a set of four small specimens apparently of this species, stated on the label to be from Fort Gibson, I. T., received by A. D. Brown from E. W. Hubbard (No. 4,718 A. N. S. P.). This is so far from the well-known range of the species (South Carolina to Florida) that we mention the matter merely to provoke further investigation.

*Polygyra neglecta* Pils. Pl. XXII, figs. 19, 20, 21.

Proc. A. N. S. Phila., 1903, 196.

This species is now known from the following localities:

*Missouri*: Springfield, Greene Co. (Wetherby); Chadwick, Christian Co. (Ferriss and Pilsbry); near Marble Cave, not far from Galena, Stone Co. (Coll. A. N. S.); Seligman, Barry Co. (Ferriss).

*Kansas*: Fort Scott, Bourbon Co. (F. A. Sampson); Erie, Neosho Co. (Ferriss).

*Arkansas*: Eureka Springs, Carroll Co. (Sampson); Rogers, Benton Co. (Ferriss and Pilsbry); Mammoth Spring, Fulton Co.

*Indian Territory*: Wyandotte, Wyandotte Nation (Pilsbry and Ferriss).

The range of the species indicated by these localities is a small area in the northern and northwestern outliers of the Ozark system, about 200 miles in extent east and west, and about 120 miles north and south. Its distribution northward in Missouri remains to be determined; but southward in Arkansas and Indian Territory it probably does not range much farther, for it would hardly have escaped the notice of Messrs. Sampson, Simpson, Ferriss and myself.

† Several specimens from Mammoth Spring, Fulton Co., near the northern boundary of Arkansas, are not quite typical, yet are decidedly nearer to *neglecta* than to *P. fraudulenta*. Whether *P. neglecta* will stand as a species or be reduced to the rank of a subspecies of *P. fraudulenta* remains to be seen when good collections from the intermediate region between its area and the Mississippi River can be examined.

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<sup>17</sup> Reported by Mr. Ferriss, who also gives the locality Hardy, Ark.

*Polygyra kiowaensis* (Simpson). Pl. XXI, figs. 13, 17-20.

*Helix* (*Mesodon*) *kiowaensis* Simpson, Proc. U. S. Nat. Mus., 1888, p. 450.

Pilsbry, Man. Conch., VIII, p. 155, pl. 50, figs. 13-15, with var. *arkansaensis*, p. 156, pl. 50, figs. 11, 12.

*Helix* (*Mesodon*) *kiowaensis* Simps., Pilsbry, Proc. A. N. S. Phila., 1889, p. 414, pl. 12, figs. 11, 12 (jaw and teeth).

*Polygyra* (*Mesodon*) *kiowaensis* Simpson var. *arkansaensis* Pils., Nautilus, IV, p. 131 (March, 1891).

*Mesodon kiowaensis* Simpson var. *arkansaensis* Pils., Sampson, Moll. of Arkansas, p. 192.

This is a solid, compact little "*Mesodon*," readily distinguished from *P. binneyana* and from the small umbilicate form of *P. indianorum* by its wide spire and narrower last whorl, and by the very narrow expansion of the internally thickened lip, which is without traces of teeth.

It was originally found at Kiowa and Limestone Gap, I. T., two stations (not towns) on the M. K. & T. R. R., where Mr. C. T. Simpson collected in 1888. A single bleached shell was taken at Eufaula, I. T.

In 1903 we worked a few days, April 9-11, at and near the Gap, and on the adjacent Sandstone "Mountains" immediately eastward. Helices were found chiefly under stones, together with copperheads and rattlesnakes. We found *P. kiowaensis* very rare. Pilsbry got two living ones, one of them not full grown, and four dead shells, three of them more or less broken; Ferriss a few more. In all of them the umbilicus is slightly narrower than in a cotype from Kiowa received from Mr. Simpson (Pl. XXI, fig. 20).

On the dry southern slope of Magazine Mountain, Logan Co., Ark., we found several dead and bleached shells similar to those from Limestone Gap, only two entire and one broken, although a great deal of time and labor was spent in the search. They occurred around and under rocks (Pl. XXI, fig. 13).

The only other locality known is from near Hot Springs, Garland Co., Ark., where Mr. Sampson in 1890 found the types of what was described as var. *arkansaensis* (Pl. XXI, figs. 17, 18). These specimens are somewhat more robust than the types of *kiowaensis*, with the aperture slightly larger and the umbilicus smaller. The specimens collected by us at Magazine Mountain and Limestone Gap demonstrate however that the differences in the umbilicus and the shape of the mouth are inconstant; and we are now convinced that the varietal distinction is untenable. The name *arkansaensis* should therefore be dropped.

The scarcity of specimens at the three widely separated localities known, while many intermediate localities have been carefully searched for snails, shows *P. kiowaensis* to be one of the rarest of American Helices.

Measurements of the specimens in Coll. A. N. S. follow, the dimensions of aperture including the peristome:

	Alt.	Diam.	Aperture.	Umbilicus.
Hot Springs.....	9.5	16	7.2 x 9	1.5 mm.
	10	16	8 x 9.2	1.5 "
Magazine Mt.....	9	15.3	7 x 8.8	1.2 "
	9.2	15.2	7.2 x 9	1.2 "
Kiowa.....	8.8	14.5	6.2 x 7.9	1.8 "
	7.7	16	6.7 x 9	1.7 "
Limestone Gap .....	8	15	6.7 x 8.2	1.5 "
	7.8	14	6 x 8	1.5 "
	....	13.3	6 x 7.7	1.3 "

The number of whorls varies from  $5\frac{1}{2}$  to  $5\frac{1}{2}$ .

*Polygyra binneyana* Pilsbry and Ferriss. Pl. XXI, figs. 9, 10, 11 (Petit Jean Mts.), 12 (Sugar Loaf).

Pils., Nautilus, XIII, p. 38 (August, 1899); Proc. A. N. S. Phila., 1900, p. 451, 1903, p. 201. Ferriss, Nautilus, XIV, pp. 26, 27, 28 (July, 1900).

This beautiful species is closely related to *P. indianorum*, but is readily distinguished from the typical form of that species by its open umbilicus. It is equally easy to separate it from *P. kiowaensis* by the larger aperture and comparatively narrower lip, which is less thickened within and more reflexed. It is found only on the mountains,<sup>18</sup> so far as our experience goes, and chiefly under large stones. It commonly does not seem to be found in the same localities with *P. indianorum*, either the one or the other occupying the ranges where we collected in 1903. Ferriss however got both at Tushkahoma, I. T., a year or two previously. It is now known from the following localities, all of them south of the Arkansas River:

*Arkansas*: Magazine Mt., Logan Co.; Petit Jean Mts., at the south border of Logan Co., or the northwestern border of Yell Co. (Ferriss and Pilsbry); Mena, Hatton's Gap and Rich Mt., Polk Co., and Gilham and Horatio, Sevier Co. (Ferriss).

*Indian Territory*: Sugar Loaf Mt. and Wister, Choctaw Nation (Ferriss and Pilsbry); Tushkahoma (Ferriss); Poteau, 21-24 mm. diam. (Ferriss).

The specimens from Indian Territory are much smaller than those from Arkansas, as may be seen from the following table, from which the variation curves may readily be plotted. At Sugar Loaf Mt. the mode is at 19.5 mm. and the largest specimen measures 23 mm. in diam., while in Arkansas the mode is at 24 to 26 mm., and the largest specimen measures 28.2 mm. Curiously enough, at Tushkahoma, where the largest *P. indianorum* were found, *P. binneyana* was small.

<sup>18</sup> Ferriss reports it living under stones in creek bottoms in Sevier and Polk counties, Arkansas. Nautilus XIV, 26-28.

The locality "Hardy, Sharp Co." given in the original description, may possibly be due to an error of some sort, as that place seems out of the general range of the species; yet until a further search is made there, we are not justified in omitting the locality.

*Measurements of Polygyra binneyana.*

Diam. in mm.	Sugar Loaf Mt., I. T.	Wister, I. T.	Petit Jean Mts., Ark.	Maga- sine Mt., Ark.	Gilham, Ark.	Mena, Ark.
16 .....	1					
16.5 .....						
17 .....	1					
17.5 .....	1					
18 .....	6					
18.5 .....	3	1				
19 .....	8	2				
19.5 .....	9	1				
20 .....	4	9				
20.5 .....	1	3				
21 .....	6	8				
21.5 .....	2	3		1		
22 .....	4	7				
22.5 .....		2	1			
23 .....	1	1	1			
23.5 .....			1			
24 .....		1	4		1	
24.5 .....			2	2		
25 .....			4	2		1
25.5 .....			4	2	1	
26 .....			5	2	1	
26.5 .....						1
27 .....						
27.5 .....				2		
28 .....				1		
Number of specimens	47	38	22	12	3	2

*P. binneyana chastatensis* n. subsp. Pl. XXI, fig. 16.

In the Chastat Mountains, four miles south of Mena, Polk Co., Ark., Mr. Ferriss found a small race in which the lip is comparatively much wider than in typical *P. binneyana*, but yet differs from *P. kiowaensis* by being strongly reflexed. Types 78,655 A. N. S. P.

Alt. 11, diam. 20 mm., whorls fully 5.

Alt. 10.5, diam. 17.7 mm., whorls 5.

Alt. 9.5, diam. 17.7 mm., whorls  $4\frac{1}{2}$ .

This is the smaller variety mentioned by Ferriss, *Nautilus*, XIV, p. 29.

*Polygyra indianorum* Pils. Pl. XXI, figs. 1, 2 (Tushkahoma), 3-6 (Limestone Gap).

*P. disecta indianorum* Pils., Nautilus, XIII, p. 39. Ferriss, Nautilus, XIV, p. 28 (July, 1900).

*P. indianorum* Pils., Proc. A. N. S. P., 1903, p. 200.

This species is still known from only a small area, the localities being as follows:

**Arkansas:** Poteau Mts., south of Hartford Station (Gwynn. P. O.), Sebastian Co., on steep slopes under stones (Ferriss and Pilsbry), April 5, 1903.

**Indian Territory:** Tushkahoma, Standley and Poteau (Ferriss); Limestone Gap (Simpson, Ferriss and Pilsbry).

At Limestone Gap, on the line of the M. K. & T. R. R., we found *P. indianorum* the commonest species, though living ones were hard to get. The shells are smaller than at Tushkahoma, rarely over 22 mm. diam., and about 60 per cent. of the whole number taken have the umbilicus more or less open. There is a perfect series of gradations from imperforate to as widely umbilicate as *P. binneyana*; only three shells of those found by Pilsbry were so open as this, and as they were specially looked for, the actual proportion is probably less than 3 per cent.

These umbilicate shells, taken by themselves, might be considered to be *P. binneyana* were it not that they connect with imperforate *indianorum* by an unbroken series of intergrades, and moreover even those most like *binneyana* have the columella perceptibly more widely dilated.

It will be seen by the table of measurements that all the specimens from Limestone Gap plotted together would form a curve with two nearly equal, strongly marked modes at the diameters 18 and 21 mm. Separated into three series according to the condition of the umbilicus, it is apparent that the *imperforate* (typical) form is larger than the *perforate*, being from 18 to 22.5 mm. diameter, with the mode at 21 mm., while the *perforate* form is from 16 to 21 mm., with the mode at 18 mm., and the few really *umbilicate* specimens are 16.3 to 16.8 mm. in diameter. This diminution of size correlated with a *perforate* or *umbilicate* axis may indicate that the Limestone Gap race is either undeveloped or retrogressive, assuming maturity while yet retaining a character of the stage of youth in the unclosed axis; the best nourished (largest) individuals attaining the normal closed umbilicus, while in those less favored the closure is imperfect, and in only the most stunted snails is the umbilicus open.

A somewhat different view would be that the Limestone Gap series is in process of diverging to form two species, one larger and imper-



forate, the other smaller and umbilicate; but as yet both characters intergrade, and all the forms certainly occur together.

*Measurements of Polygyra indianorum.*

Diam. in mm.	Limestone Gap.			Tushkahoma, I. T.	Poteau Mts., Ark.
	Imperforate.	Perforate.	Umbilicate.		
16		1			
16.5			2		
17		2	2		
17.5		7			
18	3	13	1		
18.5	2	9			
19	5	8			
19.5	1	6			
20	6	6			
20.5	5	4			
21	14	4			
21.5	3				2
22	3				
22.5	2				
23					2
23.5					4
24				5	3
24.5					
25				6	2
25.5				1	2
26				7	1
27				3	
28				1	
28.5				1	
No. of variates.....	45	60	5	24	16

*Polygyra indianorum* *lioderma* Pils. Pl. XXI, figs. 14, 15.

Proc. A. N. S. Phila., 1902, p. 511.

Red Fork, Creek Co., I. T. This form is intermediate between *P. indianorum* and *P. roemeri*, being much less regularly and less distinctly striate than the former. It has not before been figured.

*Polygyra roemeri* (Pfr.) is a terminal member of the *divesta-indianorum* series, smoother than any of the more northern forms.

*Polygyra divesta* (Gld.).

This snail is now known from the following places. Names of the collectors are indicated by initials: F., Ferriss; P., Pilsbry; S., Sampson.

Missouri: Springfield, Green Co. (F.); Cedar Gap, Wright Co. (F.); Chadwick, Christian Co. (F. and P.); Seligman, Barry Co. (F.); also reported from Jasper and Dade counties (S.).

Kansas: Fort Scott, Bourbon Co. (S.).

**Arkansas:** Rogers, Benton Co. (F. & P.); Eureka Springs, Carroll Co. (S.); Blue Mt. Station and Magazine Mt., Logan Co. (F. & P.); Carrion Crow Mt., Pope Co. (F.); Petit Jean, Yell Co. (F.); Hot Springs, Garland Co. (F., S.); Mablevale, Pulaski Co. (C. W. Johnson); Washita Springs (Gould, type loc.); also reported from Crawford, Franklin, Sebastian and Conway counties (S.).

**Indian Territory:** Fort Gibson, in the Cherokee country (E. W. Hubbard, C. T. Simpson).

**Louisiana:** Grand Cane, De Soto Parish (Williamson).

*P. divesta* has been reported from Bowling Green, Ky., by Miss S. F. Price (*Nautilus*, XIV, 75), but I have not seen specimens from there and am not sure of the identification. It has also been recorded from "Vernon Co., Miss.," but there is no county of that name in the State. No reliable record of its occurrence east of the Mississippi River exists.

Throughout its range the species is very uniform in character, the diameter ordinarily being from 17 to 21 mm. At Chadwick, where nearly all land snails are dwarfed, the shells are remarkably small, a series of 23 measuring as follows:

No. of specimens.....	1	3	6	3	4	4	1	1
Diam. in mm.....	13.6	14.5	15	15.5	16	16.5	17	18

*Polygyra albolabris alleni* (Wetherby).

Proc. A. N. S. Phila., 1903, p. 197.

Several small series were taken in 1903 showing variations similar to those discussed in a former paper. Aside from size the shells do not vary much. The diameters are tabulated below for ten localities where we took the species in 1903.

Two large specimens from the north side of Magazine Mountain show a parietal tooth. We do not remember seeing this tooth developed in the trans-Mississippian race of *albolabris* hitherto.

The largest specimens were taken on steep, damp and rocky northern slopes, *without reference to elevation*. At Wyandotte, at an elevation of about 900 feet above the sea, they live on the steep, rocky bluff facing the river. At Magazine Mountain the series of large shells came from the edges of the talus, just under the great sandstone cliff along the northern side of the plateau summit, at an elevation of about 2,700 feet; while at an equal elevation on the dry south side, with the same sort of rock and abundant cover, the shells were small, 25 mm. diam., and at the base of the mountain still smaller, 24.5 mm. At Chadwick, where the country rock is limestone, the individuals are small, 22 to 25 mm.

*The size of individuals in this species and area seems to be dependent upon the abundance of cryptogamic food, and is therefore a function of*

Diam. in mm.	Chadwick, Mo.	Monett, Mo.	Mammoth Spr., Ark.	Rogers, Ark.	Magazine Mt., N. side, Ark.	Magazine Mt., S. slope, Ark.	Petit Jean Mts., Ark.	Poteau Mts., Ark.	Wyandotte, I. T.	Sugar Loaf Mt., I. T.
22 .....	1	1	3							
22.5 .....			3							
23 .....	2		4				1			1
23.5 .....	1		1				1			2
24 .....	1						1			
24.5 .....	1		1			2	1			1
25 .....	1					2	1			1
25.5 .....							2		1	
26 .....				1				1	3	
26.5 .....					2			1	1	
27 .....					3				4	
27.5 .....					2				2	
28 .....				1	5				2	
28.5 .....					1				2	
29 .....										
29.5 .....										
30 .....									1	
31 .....					1					
Total No.....	7	1	12	2	14	4	7	2	16	5

the particular station rather than related to elevation or geologic formation.

It is likely that the specimens from Seligman, Mo., which exhibited two sizes without intermediate forms, commented upon in these *Proceedings* for 1903, p. 198, were from two stations of diverse physical features.

There has also been recorded from Daingerfield, Morris Co., Tex., a small form of *albolabris*, collected by Mr. W. L. McDaniel (J. A. Singley, *Contrib. to Nat. Hist. of Texas, Mollusca*, p. 305; *Fourth Ann. Rep. Geol. Surv. of Texas*, 1892). Mr. Singley also reports that a colony of *P. albolabris* from North Carolina has been established by Mr. Askew at Tyler, Smith Co., Tex.

*Polygyra zaleta osarkensis* n. subsp. Pl. XXII, figs. 26-29

*Mesodon exoletus* Binn., Sampson, Preliminary List of the Mollusca of Arkansas, *Ann. Rep. Geol. Surv. of Ark.* for 1891, II, p. 190.

The shell is smaller than *P. zaleta* (Binn.), with the spire usually more elevated, having somewhat the aspect of *P. elevata*; whorls  $5\frac{1}{2}$ , more slowly increasing, the last, in dorsal view, narrower. Aperture with a larger parietal tooth; columellar prominence usually well developed. Bright yellow, usually with a pink under-tint showing through on the spire. The cuticle is often partly or wholly worn from living shells.

Alt. 16.5, diam. 23 mm.

Alt. 15.5, diam. 23.5 mm.

Alt. 15.5, diam. 23 mm.

Alt. 15.5, diam. 21.5 mm.

- Types No. 91,329, A. N. S. P., from Sugar Loaf Mt., Choctaw Nation, I. T., collected by Pilsbry and Ferriss, April 6 and 7, 1903.

While readily distinguishable from typical *P. zaleta* (or *exoleta*, as it is commonly known), this form has much in common with the race of northern Alabama, such as Mr. H. E. Sargent found at Woodville. In Woodville shells also the parietal tooth is very large, and the size is ordinarily that of typical *zaleta*, though occasional dwarf specimens are not larger than the Ozark race.

In fresh specimens of *P. z. ozarkensis* there is usually an appearance of angulation at the periphery in front, though no actual angle exists. The more elevated specimens might easily be mistaken for *P. elevata*, which however differs by its columellar plate, the irregular shape of the aperture and the more closely wound whorls.

Typical *P. zaleta* we have seen from Black Hawk Hollow, Fort Madison, Lee Co., Iowa (T. Van Hyning), but it has no extensive distribution in Iowa. Binney reports it from Missouri, but all the specimens before us from that State are the variety *ozarkensis*.

Binney specified no type locality for his *Helix zaleta*, merely stating that it is "common in the States bordering on the Ohio river, and in the western parts of Virginia and Pennsylvania." In order to have a definite standard, Cincinnati, O., may be considered type locality, specimens from that place agreeing well with his description and figures.

The following localities are now known for *P. z. ozarkensis*. Where no collector is mentioned the shells were taken by the authors:

*Missouri*: Current River; Seligman, Barry Co.; Cedargap, Wright Co.; Springfield, Green Co. (S. Weller); Chadwick, Christian Co.

*Arkansas*: Eureka Springs (Sampson); Mammoth Spring, Fulton Co.; Harrison, Boone Co. (Stuart Weller); Rogers, Benton Co.; Magazine Mt., Blue Mt. Station and Petit Jean Mts., Logan Co.; Mablevale, Pulaski Co. (C. W. Johnson); Little Rock; Poteau Mts., south of Gwynn P. O., Hartford Station, Sebastian Co.; Rich Mt. and Mena, Polk Co.; Little River, Little River Co. In addition to these places from which we have seen specimens, Mr. Sampson records *P. exoleta* from Washington Co.

*Indian Territory*: Sugar Loaf Mt., close to the western boundary of Sebastian Co., Ark.; Wyandotte.

*Measurements (diameter) of Polygyra zalea ozarkensis.*

Diam. in mm.	Cedargap, Mo.	Seigman, Mo.	Mammoth Spr., Ark.	Magazine Mt., N. side	Magazine Mt., S. side.	Petit Jean Mts., Ark.	Poteau Mts., Ark.	Mablevale, Ark.	Mena, Ark.	Sugar Loaf Mt., I. T.
19 .....			1							
20 .....	1									
20.5 .....	1									
21 .....	4	1	1							1
21.5 .....		2				2				3
22 .....	1	2	3	3	1	3				12
22.5 .....		1	1	6	1	2			2	5
23 .....	1	1	1	7	3	8	5			7
23.5 .....				9	1	1	1			
24 .....				12	3	1	4	1		
24.5 .....				2		1	2		1	
25 .....				1	3	1		2	1	
No. of speci- mens .....	8	7	7	40	12	19	12	3	4	28

Of this species only two or three, at most, of the lots taken are sufficiently large to be expected to yield normal curves. It would seem however that there is no difference in size between shells from the shady north side of the summit of Magazine Mountain and those from its dry southern slope. The Poteau Mountain and Petit Jean Mountain lots are from northern exposures, but these mountains are rather dry. The Sugar Loaf lot is from shady, leafy ravines, but not especially well watered or damp. The snail however is not one which affects moist or rocky situations. It lives preferably on slopes leaf-carpeted over a rich humus, and rolls out of the leaves where one is raking for *Omphalina*. On the north side of Magazine Mountain we took them on the leafy slope just below the great rock-talus.

From localities in Arkansas other than those tabulated but few (one to three) specimens have been seen. They agree with those in the table with three exceptions: At Rich Mountain Mr. Ferriss took two specimens, 23.5 and 26 mm. in diam.; in Little River Co. three taken measure 24.25 and 26.5 mm.; and two from Little Rock are large and heavy, 26 and 27.5 mm. These larger shells approach the eastern *P. zalea*, and indeed intergrade with that in size.

*Polygyra elevata* (Say). Pl. XXII, figs. 22-25 (Hardy, Ark.).

Sampson, Kansas City Review of Science and Industry, February, 1883, p. 551; Bull. Sedalia Nat. Hist. Soc., August, 1885, p. 19. (Sedalia, Mo.)  
Moll. of Arkansas, Ann. Rep. Geol. Surv. 1891, p. 190.

Simpson, Proc. U. S. Nat. Mus., 1888, p. 450. (Fort Gibson, I. T.)

Call, Bull. Washburn College Laboratory of Nat. Hist., I, No. 7, p. 202, December, 1886. (Wyandotte, Kan.)

Very few records have been made of the existence of this species west of the Mississippi River. The form from this region is in the average smaller than Eastern shells. Some care is required to distinguish it from *P. zaleta ozarkensis*. A set of fine shells from Springfield, Green Co., southwestern Missouri (A. G. Wetherby collection), is in the collection of Bryant Walker, who gives the following measurements:

Alt. ....	17	16.75	16	15.75	15 mm.
Diam. ....	21.5	20.25	19.75	20.5	20.25 "

Sampson records *P. elevata* from Sedalia, Mo. We have not seen specimens. One shell (Ferriss Coll.) was taken by Prof. Stuart Weller near or at Harrison, Boone Co., Ark., measuring 17 x 22.5 mm. At Hardy, Sharp Co., also in northern Arkansas, a series of five taken by Mr. Ferriss measure:

Alt. ....	15.5	16	16	17	17 mm.
Diam. ....	21.5	20	20.5	21.5	22 "
Whorls. ....	6½	6½	6½	6½	6½

Several of these are illustrated for comparison with *P. z. ozarkensis*, from which the greater number of whorls and the oblique, straightened basal lip, usually with a tooth and notch at its outer end, distinguish *P. elevata*.

Other records from Arkansas are given by Mr. Sampson: Carroll, Crawford, Clark, Jackson Cos., and Augusta, Woodruff Co. (Call). He remarks that it is "found on low ground or adjacent thereto." *P. elevata* seems to be a species which has penetrated only the northern edge of the Ozark region. The specimens reported from Fort Gibson, I. T., should be re-examined, for they may prove to be *P. z. ozarkensis*, a form easily mistaken for *P. elevata*.

*P. elevata* occurs as a pleistocene fossil in the Mississippi river bluffs at Alton, Ill., and Natchez, Miss.

#### *Polygyra thyroides* (Say).

Taken by us at Chadwick, Christian Co., Mo.; Rogers, Benton Co., and Mammoth Spring, Fulton Co., Ark., and in Indian Territory at Wyandotte, Wyandotte Nation, Vinita, Cherokee Nation, and Wister, Choctaw Nation. Also at San Marcos, Hays Co., in central Texas, and reported by Ferriss from Smithville, Tex.

#### *Polygyra clausa* (Say).

Chadwick, Christian Co., Mo.; Mammoth Spring, Fulton Co., Ark.; Vinita, Cherokee Nation, I. T.

## PUPILLIDÆ.

*Pupoides marginatus* (Say).

Rogers, Benton Co., Ark.; Limestone Gap, Choctaw Nation, I. T.

*Biddaria contracta* (Say).

Rogers, Benton Co., Ark.; Limestone Gap, I. T.

*Biddaria armifera* (Say).

Chadwick, Christian Co., and Monette, Barry Co., Mo.; Rogers, Benton Co., Ark.; Vinita and Limestone Gap, I. T.

*Biddaria procera* (Gld.).

Rogers, Benton Co., Ark.

*Biddaria pentodon* (Say).

Hillside along creek south of Blue Mountain Station, Logan Co., Ark.

*Vertigo rugosula* Sterki.

Limestone Gap, I. T., one specimen.

*Strobilopsis labyrinthica texasiana* Pils. and Ferr.

Wyandotte and Limestone Gap, I. T. (Ferriss and Pilsbry); Fort Gibson (Hubbard). Silver Lake, Kan., and Pottawatomie Co., Okla. (J. B. Quintard).

## VALLONIIDÆ.

*Vallonia parvula* Sterki.

Fort Gibson, Cherokee Nation, I. T. (E. W. Hubbard, Coll. A. N. S. P.). This is the only *Vallonia* we have seen from Arkansas or Indian Territory. No other species or locality has been recorded.

## CIRCINARIIDÆ.

*Circinaria concava* (Say).

Chadwick, Christian Co., Mo. Magazine Mt., Logan Co., Ark., north side of the summit; also on the south side.

## ZONITIDÆ.

*Gastrodonta ligera* (Say).

We took this snail at Vinita, Cherokee Nation, I. T., in abundance. We have also seen specimens from Fort Gibson, I. T., taken by Mr. Simpson in 1888. These points mark its western limit so far as known. Mr. Sampson reports it from five counties in Arkansas (*Moll. of Ark.*, p. 182). It is not known from southern Arkansas or Texas.

In Louisiana and the adjacent part of Texas *G. intertexta* replaces *ligera* in the low country, but that species has not been found in the Ozark region.

*Gastrodonta demissa brittsi* (Pils.).

*Zonites brittsi* Pils., Nautilus, V, p. 99, 1892 (Hot Springs, Ark.).

*Gastrodonta demissa* var. *lamellata* Pils., Nautilus, XIII, p. 107, January, 1900 (Tushkahoma and Poteau, I. T.).

*G. demissa* and var. *brittsi* and *lamellata* Pils., Proc. A. N. S. Phila., 1900, p. 456; 1903, p. 213. Ferriass, Nautilus, XIV, July, 1900, p. 31.

*Zonites demissa* Binn., *brittsi* Pils. and *gularis* Say, Sampson, Prelim. List Moll. of Ark.; Ann. Rep. Geol. Surv. Ark. for 1891, Vol. II, pp. 182, 183, Nos. 5, 6, 16.

*Zonites acerra* Lewis, Simpson, Proc. U. S. Nat. Mus., 1888, p. 451 (Fort Gibson, I. T.).

The shell varies from imperforate to as widely perforate as *G. demissa*; the periphery is well rounded in adults, and the basal and outer walls of the aperture have a white callous lining, showing yellow outside on the last third of the base, the rest of the shell being olivaceous. *Young shells usually have at some stage of growth an entering callous lamella within the basal lip, at the position of the similar lamella in G. gularis.* Alt. 6.5, diam. 10 mm., whorls  $6\frac{1}{2}$ .

Type locality, Hot Springs, Garland Co., Ark.; distribution, the Ozark uplift in Arkansas and adjacent portions of Missouri and Indian Territory.

This form has been much misunderstood, and no fewer than five names have been applied to it. It was not until the series collected by us in 1903 was studied that the problem reached solution. In any good series from one place, it is found that some shells possess the basal lamina within the mouth, and that while these shells may be of various sizes, *they fall short of the maximum size of the toothless individuals found with them.* In the fully adult shells from any colony the lamina has always been absorbed, so far as our experience goes. But specimens of any size may also want the lamina; so that the lamellate stage may be a transitory feature appearing sooner or later, or possibly it may not be developed at all in some individuals.

In one lot of 24 shells from Hot Springs, the largest one showing a lamina is 8.5 mm. in diam., and the lamina is very low, hardly noticeable. All of the 7 from this size down to the smallest (5.5 mm.) are laminate, most strongly so in the youngest. None of the larger shells (16 individuals, up to 10 mm. diam.) show a lamina. Fig. 2 represents a series of these shells, drawn to the same scale.

The types of *G. brittsi* were specimens just past the laminate stage, but still immature.

In some colonies the laminate stage persists in somewhat larger shells than above indicated.

The size of the umbilical perforation varies, and we do not now think that any racial distinction can well be based upon its variations. The



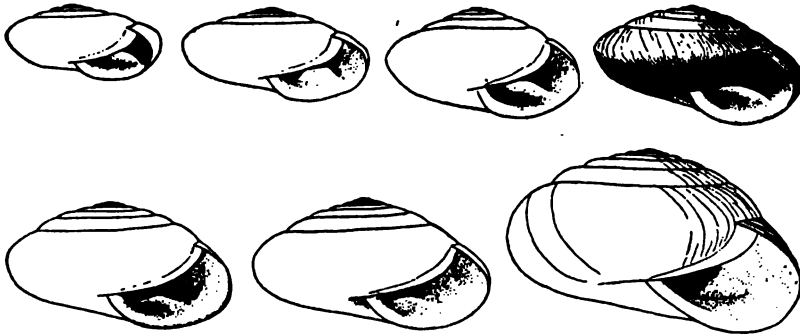


Fig. 2.—*G. d. brittsi*, Hot Springs; series showing changes with growth,  $\times 4$ .

subspecies differs from typical Eastern *G. demissa* chiefly by the usual development at some stage of the internal lamina, whereas we have never seen this structure in any Eastern examples of the species.

*G. d. brittsi* is a more primitive form than *G. demissa*, and its chief claim to renown is that it supplies the link between the toothed Gastrodonts, such as *G. gularis*, and those without teeth, *G. acerra*, *cerinoidea*, *ligera* and *intertexta*, with which *demissa* has hitherto been associated. When young, *G. d. brittsi* belongs to the dentate group, but adults qualify to enter another class.<sup>19</sup>

Like the Gastrodonts of the Appalachians, these Ozarkians vary interminably in minor features with locality. At Magazine Mt., Logan Co., Ark., we took it sparingly at all elevations. Also on the Petit Jean Mts., south of Magazine, where they are 9 to 10 mm. in diam., the young of 5 mm. being laminate. Also on the Poteau Mts., south of Gwynn, Sebastian Co., and on Sugar Loaf Mt., in Indian Territory, west of Gwynn, where those up to three-fourths grown are laminate.

At Chadwick, Christian Co., Mo., there is a large *acerra*-like form, diam. 12 mm., with  $6\frac{1}{2}$  whorls and coarse sculpture. Only a few were taken, none being of the laminate form. The identification of this lot remains a little uncertain.

The largest specimens we have seen are from Mena, Polk Co., Ark., where they measure up to 8.5 x 14 mm., with 7 whorls. A young one, 7.5 mm. diam., is laminate, as are all those of smaller size. The

<sup>19</sup> It may be noted that the *ligera* group was not included in *Gastrodonta* by Binney and former authors. It was transferred to that genus by Pilsbry some years ago on anatomic grounds. The conchologic connection is now established.



Fig. 3.—*G. demissa brittsi*, Mena, Ark. The outline figures are natural size.

adults are very similar to *G. acerra*, and doubtless it was this form which Simpson records as *acerra* in his Indian Territory list.

Numerous other localities for *G. d. brittsi* may be found in the works cited above, under the names *demissa*, *brittsi*, *lamellata*, *acerra* and *gularis*.

***Zonitoides arborea* (Say).**

Chadwick, Christian Co., Mo.; Magazine Mt. and Blue Mt. Station, Logan Co., Ark.; Vinita, Sugar Loaf Mt. and Limestone Gap, I. T.

The specimens from the summit of Magazine Mountain are small with a small umbilicus, and smoothish, glossy surface with the most delicate sculpture in place of the usual wrinkles. The very minute dense spiral striation is better developed than usual in *Z. arborea*.

***Zonitoides minuscula alachuana* (Dall).**

We took this in Logan Co., Ark., at Magazine Mountain, both on the north and south sides of the summit; very scarce. This race differs from Northern *Z. minuscula* by its much wider umbilicus. It was originally described from Alachua Co., Fla.

***Vitrea multidentata* (Binn.).**

Proc. A. N. S. Phila., 1903, p. 208, Pl. X, figs. 6, 6a.

Magazine Mt., Logan Co., Ark., on rocks in the great talus of the cliff along the northern side of the summit. The specimens are very fine and typical, usually with two rows of five or six teeth each, but some show three rows.

This is very much farther west than the species has hitherto been recorded, and is the only locality known west of the Mississippi River.

***Vitrea simpsoni* (Pils.).**

*V. significans* and *V. simpsoni* have no spiral sculpture, only a faint fine granulation, when examined with a high power. The radial grooves of the upper surface are weaker in *V. simpsoni* than in *V. significans*, especially on the inner whorls. We took the typical form of *V. simpsoni* at Limestone Gap, I. T., and along a creek about ten miles

southwestward. The shells measure 4.5 to 5 mm. diam. and have nearly  $5\frac{1}{2}$  whorls.

At the following places a small race of *V. simpsoni* occurs. The largest shells are barely 4 mm. in diam., with 5 whorls. The umbilicus is smaller and the aperture less lengthened than in the typical form.

*Missouri*: Chadwick.

*Arkansas*: Rogers, Hardy, Blue Mountain Station, Petit Jean Mountains, Morris Ferry.

*Indian Territory*: Wyandotte, Poteau.

*Vitrea aulacogyra* n. sp.

Shell similar to *V. petrophila* but very much larger, with sculpture of close, obliquely radial striae on the upper surface, the striae fine and close on the inner whorls, much coarser on the last; striae and intervening grooves about equal. Upper surface slightly convex, nearly flat. Whorls  $5\frac{1}{2}$ , very slowly widening, the last very much wider, rounded peripherally, the base smoothish, not distinctly striate. Aperture as in *V. petrophila*. Umbilicus slightly smaller in proportion, one-fourth the diameter of the shell.

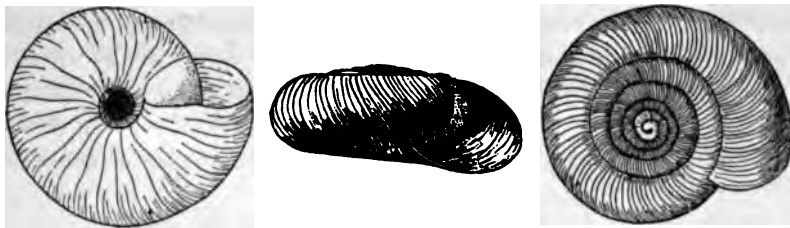


Fig. 4.—*V. aulacogyra*,  $\times 4$ .

Alt. 3.3, diam. 8 mm., umbilicus 2 mm. wide.

Magazine Mountain, in the talus at the north side of the summit.

This form evidently stands close to *V. petrophila*, from which it differs in the close sculpture of all the whorls and the larger size. The maximum diameter of *petrophila* in the Ozarks, judging from over 30 specimens from various places, is  $5\frac{1}{2}$  mm., with  $5\frac{1}{2}$  whorls, the umbilicus 1.6 mm., contained  $3\frac{1}{2}$  times in the diameter. The largest Tennessee specimen before us measures 5.6 mm., with  $5\frac{1}{2}$  whorls. Bland gives the diameter of *petrophila* as 6 mm., with  $5\frac{1}{2}$  to 6 whorls.

*V. aulacogyra* is excessively rare. Only one specimen, perfect though bleached, was found.

*Vitrea hammonis* (Swan).

Chadwick, Mo.; Magazine Mt., Logan Co., and Rogers, Benton Co., Ark. Exceedingly fine spiral striae are visible on these specimens, in a favorable light, under the compound microscope. In Eastern *V. hammonis* they are generally absent. *V. petrophila* may be distinguished from *hammonis* by its more numerous and more closely coiled whorls.

*Vitrea indentata* (Say).

Monett, Barry Co., and Chadwick, Christian Co., Mo. Rogers, Benton Co.; Magazine Mountain and Blue Mountain Station and Petit Jean Mountain, Logan Co., Ark. Wyandotte, Vinita, Sugar-loaf Mountain, South McAlester and Limestone Gap, Indian Territory.

In the Territory the shells are distinctly perforate (var. *umbilicata* 'Singley' Ckll.), but are not quite so large as the Texan form. It is here, as in Texas, the commonest of the smaller zonitids.

*Vitrea petrophila* (Blond).

Arkansas: Magazine Mountain north of the summit, Logan Co. It was found by Ferriss in 1900 at Mena, Polk Co., near the western border of the State (*Nautilus*, XIV, 30).

The specimens from Magazine Mountain differ from the types from East Tennessee in being brown in color, like *Zonitoides arbores*, while the typical form is of a pale corneous tint. There are fully  $5\frac{1}{2}$  whorls. *V. p. pentadelpia* has but  $4\frac{1}{2}$ . This species belongs to the section *Glyphyalinia*. The westward extension of this species is unexpected. It will probably prove to be more widely spread in the Carolinian area than is now known.

*Omphalina fuliginosa* ('Griff.' Binn.).

Small, globose specimens were taken on the northwestern confines of the Ozark area at Wyandotte, I. T., and Rogers, Benton Co., and Poteau Mountain, south of Hartford Station, Sebastian Co., Ark. From the shells alone it would be difficult to decide upon the species, but the soft anatomy is certainly nearer *fuliginosa* than *friabilis*.

*Omphalina fuliginosa ozarkensis* n. subsp.

The shell is light and thin, varying from dusky olive to olive-chestnut, dusky near or at the lip. The surface is indistinctly marked with fine spiral striae. Whorls  $4\frac{1}{2}$ , the earlier ones invariably worn and white or whitish. The mantle is pale gray, the branches of the vena cava black, pulmonary vein and its branches not pigmented.

Alt.	16	13 mm.
Diam.	23.3	21.5 "

Petit Jean Mountains, south from Magazine Mountain, type loc.; also Magazine Mountain, chiefly on the north side of the summit, buried in earth under dead leaves on shady hillsides, the apex only exposed. Ferriss and Pilsbry, March 28 to April 2, 1903. Also Sugar-loaf Mountain, on the boundary between Arkansas and Indian Territory.

In the field this form is instantly recognizable by the black lines of the pallial region, sharply defined against a pale ground, and readily visible through the shell. In spirit this black pigment remains unchanged.

*Omphalinas friabilis* (W. G. Binn.).

Arkansas: Mablevale, Pulaski Co. (C. W. Johnson); Rocky Comfort, Little River Co. (Ferriss, 1900). Mr. Sampson ('93, p. 181) reports *friabilis* from several other counties, but as his list does not mention *O. fuliginosa* it is almost certain that he included the two species in his records.

Texas: San Marcos, Hays Co., under dead leaves in the thicket along a rill on the northeast side of San Marcos River, abundant.

The anatomical distinctions between *O. friabilis* and *fuliginosa* will be discussed elsewhere. The shells may be distinguished by the smaller apex, narrower and more closely coiled early whorls of *friabilis*, in which moreover the apical whorls are *smooth, polished, whitish-corneous and unworn*, while the summit in southwestern *fuliginosa* is invariably worn, the cuticle removed from the earlier whorls.

*Euseonulus chersinus dentatus* (Sterki).

Nautilus, XII, p. 116, February, 1899.

Magazine Mt., on the north side of the summit; also under stones on the hills along the creek south of Blue Mt. Station; both in Logan Co., Ark. Two young specimens from each place. This form was also taken at Hardy, Ark. (Ferriss).

These two are, we believe, the only localities known for *dentatus* west of the Mississippi.

#### PHILOMYOIDÆ.

*Philomyeus carolinensis* (Bosc.).

Chadwick, Mo.; Roger and Magazine Mountain, Ark.; Wyandotte, Sugar-loaf Mountain, Vinita and Wister, I. T.

#### ENDODONTIDÆ.

*Pyramidula alternata* (Say).

Arkansas: Magazine Mt., Logan Co., from the summit to the base

a finely striate form with rounded periphery. At the following localities the striation is slightly coarser and the periphery weakly angular: Petit Jean Mts., Logan Co.; Poteau Mts., Sebastian Co.

*Indian Territory:* Wyandotte and Wister, slightly angular specimens; Sugar Loaf Mt., rounded periphery and coarse sculpture.

*Pyramidula perspectiva* (Say).

Chadwick, Christian Co., southwestern Mo.; Arkansas, Magazine Mt., Logan Co., somewhat abundant on the north side of the summit, a few taken also on the dry southern side down to the railroad station.

At Rogers, Benton Co., Ark., a small form of *perspectiva* was found, normal in form and sculpture but only 7 mm. diam. The species is elsewhere so constant in size that this local form is noteworthy.

*Helicodiscus parallelus* (Say).

*Arkansas:* Rogers, Benton Co.; Magazine Mt., Logan Co.

*Indian Territory:* Wyandotte, Vinita, South McAlester and Limestone Gap.

The specimens from Magazine Mt., where a large series was taken, are scarcely over 3 mm. in diameter with  $4\frac{1}{2}$  whorls. Those from the Territory are slightly larger, 3.8 mm., with 5 whorls. We saw nothing of *H. fimbriatus* Weth., reported from this region by Simpson.

*Succinea avara* Say.

Magazine Mt., north side of summit, and Petit Jean Mts., Logan Co., Ark.; Vinita, Wister and Limestone Gap, I. T.

#### LYMNÆIDÆ.

*Lymnaea desidiosa* Say.

Rogers, Ark.

*Lymnaea columella* Say.

Oklahoma City, Okla. (Ferriss).

*Planorbis trivolvis* Say.

Rogers, northeastern Ark.; Limestone Gap, I. T.

*Ancylus kirklandi* Walker.

Hardy, Sharp Co., Ark. (Ferriss). Erroneously reported as *A. haldemani* in these *Proceedings* for 1900, p. 457, according to Walker, *Nautilus*, XVII, July, 1903, p. 29.

In Texas we took it at New Braunfels, on rushes in Comal Creek. It was also sent from Garcitas Creek and the Guadalupe River, Victoria Co., by Hon. J. D. Mitchell (1899).

*Ancylus walkeri* n. sp.

Shell pale corneous, thin, oval, the right and left sides equally curved;

moderately elevated, the apex depressed, radially striate, situated behind the posterior third, and much nearer the right than the left margin. Surface densely and minutely striate concentrically, and showing faint traces of radial striæ. Anterior and left slopes convex; right and posterior slopes concave. Length 4.3, width 2.75, alt. 1.4 mm.

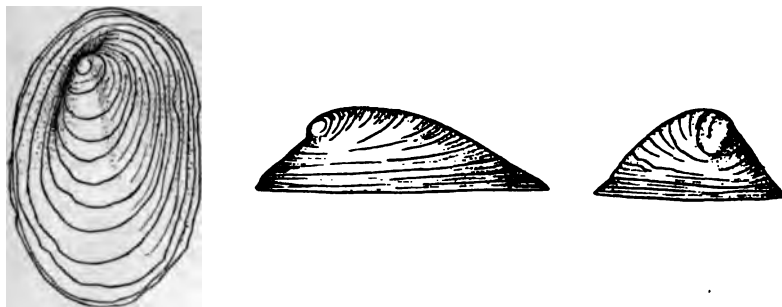


Fig. 5.—*Ancyclus walkeri*.

**Arkansas:** Rogers, Benton Co., on fallen leaves in a fish pond, Ferriss and Pilsbry, 1903. Types No. 87,479, A. N. S. P.

This *Ferrissia* has nearly as excentric an apex as *A. excentricus*, decidedly more so than in *A. rivularis* or *tardus*. The summit of the shell is in front of the somewhat depressed apex. It is named for Mr. Bryant Walker, who has published an excellent revision of the Eastern *Ancylus*.

#### PHYSIDÆ.

***Physa integra* Hald.**

Rogers, Benton Co., Ark. A brown form of the species.

***Physa albofilata* Anc.**

Chadwick, Christian Co., Mo.; abundant and the only *Physa* found. In small rivulets it is dwarfed.

***Physa rhomboidea* Crandall.**

Nautilus, XV, p. 44, pl. 2, figs. 6, 7, August, 1901.

Cf. A. Springer, Proc. A. N. S. Phila., 1902, p. 514, pl. XXVI.

The shells we took from the stream running through Limestone Gap, I. T., agree with this form received from Mr. Crandall.

#### POMATIOPSIDÆ.

***Pomatopsis lapidaria* (Say).**

Rogers, Benton Co., Ark.

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## EXPLANATION OF PLATES XX, XXI, XXII.

- PLATE XX.—Figs. 1-5.—*Polygyra jacksoni*, Petit Jean Mountains, Ark.  
 Figs. 6, 7.—*Polygyra jacksoni deltoidea*, Fort Gibson, I. T. Cotypes.  
 Figs. 8, 9, 10, 11.—*Polygyra jacksoni simpsoni*, Wyandotte, I. T. Cotypes.  
 Figs. 12.—*Polygyra dorfeuilliana*, Mammoth Spring, Mo.  
 Figs. 13-16.—*Polygyra dorfeuilliana*, Hardy, Ark.  
 Figs. 17-19.—*Polygyra dorfeuilliana sampsoni*, Wyandotte, I. T.  
 Figs. 20, 21, 22.—*Polygyra dorfeuilliana perstriata*, Mena, Ark.  
 Fig. 23.—*Polygyra dorfeuilliana percostata*, Red River, Ark. Cotype.  
 Fig. 24.—*Polygyra dorfeuilliana perstriata*, Tushkahoma, I. T. Cotype.
- PLATE XXI.—Figs. 1, 2.—*Polygyra indianorum*, Tushkahoma, I. T.  
 Figs. 3-8.—*Polygyra indianorum*, Limestone Gap, I. T.  
 Figs. 9-11.—*Polygyra binneyana*, Petit Jean Mountains, Ark.  
 Fig. 12.—*Polygyra binneyana*, Sugar-loaf Mountain, I. T.  
 Fig. 13.—*Polygyra kiowaensis*, Magazine Mountain, Ark.  
 Figs. 14, 15.—*Polygyra indianorum lioderma*, Red Fork, I. T. Cotypes.  
 Fig. 16.—*Polygyra binneyana chastatensis*, Chastat Mountains, Ark. Cotype.  
 Figs. 17, 18.—*Polygyra kiowaensis* (types of var. *arkansaensis*), Hot Springs, Ark.  
 Fig. 19.—*Polygyra kiowaensis*, Limestone Gap, I. T.  
 Fig. 20.—*Polygyra kiowaensis*, Kiowa, I. T. Cotype.
- PLATE XXII.—Fig. 1.—*Polygyra inflecta* Say. Type.  
 Figs. 2, 3.—*Polygyra inflecta*, Chadwick, Mo., form No. 1.  
 Figs. 4-6.—*Polygyra inflecta*, Chadwick, Mo., form No. 2.  
 Figs. 7-9.—*Polygyra inflecta*, Wyandotte, I. T.  
 Fig. 10.—*Polygyra inflecta media*, Seligman, Mo. Type.  
 Fig. 11.—*Polygyra edentata*, Chester, Ark.  
 Figs. 12-14, 17, 18.—*Polygyra edentata magazinensis*, Magazine Mountain, Ark. Cotypes.  
 Figs. 15, 16.—*Polygyra edentata* Porter, Ark.  
 Figs. 19, 20, 21.—*Polygyra neglecta*, Chadwick, Mo.  
 Figs. 22-25.—*Polygyra elevata*, Hardy, Ark.  
 Figs. 26-29.—*Polygyra zaleta ozarkensis*, Sugar-loaf Mt. Cotypes.  
 Figs. 30-32.—*Polygyra obstricta occidentalis*, Northern Ark. Cotypes.

**OBSERVATIONS****MADE IN 1906 ON GLACIERS IN ALBERTA AND BRITISH COLUMBIA.**

BY GEORGE, JR. AND WILLIAM S. VAUX.

At the present time the glaciers close to the line of the Canadian Pacific Railway located in the western part of Alberta and the eastern of British Columbia offer very convenient opportunities for study and comparison. The most accessible examples are found on the western slopes of the Selkirk and Rocky Mountain ranges, where they are fed by the immense precipitation from the warm winds blowing eastward from the Pacific Ocean. In common with almost all glaciers throughout the world it is found that these are receding, and while the changes between year and year are not great when the immense area of the glacier is considered, in a decade or century sweeping differences must be noted.

That the general tendency for a great many years has been to recede every glacier in this region points with unmistakable evidence. At no very remote date the Illecillewaet and Asulkan Glaciers met and flowed as one down the valley which is now shared in common by their streams; while the beautiful Lake Louise, more than 225 feet deep at the centre, owes its existence to the dying Victoria Glacier which now extends only to within one and one-half miles of the upper edge and is year by year depositing in the lake masses of glacier mud, ultimately to reduce it to a muskeg marsh. Thus at every turn the life span of glacier, mountain and lake may be read, and the creating and destroying forces seen at work on every hand.

The much greater activity of glaciers located on the western slopes of the mountains as compared with those on the eastern has already been noted, and it may also be observed that the snowfall on the higher ranges is greater than on the lower in corresponding positions, even though the latter may lie farther to the west, and consequently nearer to the origin of the moisture-bearing winds from the Pacific Ocean.

The amount of precipitation of snow on the several mountain slopes and in the passes adjacent to the railway has always been a matter of much interest to those concerned in protecting the roadbed during the winter, and also to students of glacier and alpine phenomena, as by comparisons made over a long series of years interesting data of cause

and effect may be obtained. Upon the completion of the railway records were started, and have been kept with more or less regularity, of the snowfall at three points near the summit of Roger's Pass on the western slope of the Selkirk Range. While of course great variations have taken place and inaccuracies have crept in, the summaries of daily measurements are here given as they have been preserved for three stations, "Cut Bank," at an elevation of about 4,000 feet, Glacier House, 4,120 feet, and "No. 18 Shed," 4,300 feet.

*Table Showing Yearly Snowfall on West Slope of Selkirk Range.*

Year.	Cut Bank.	Glacier House.	No. 18 Shed.
1886-1887.....	No record.	No record.	42 ft. 0 ins.
1887-1888.....	No record.	No record.	34 " 0 "
1888-1889.....	14 ft. 5 ins.	No record.	28 " 0 "
1889-1890.....	20 " 9 "	No record.	33 " 3 "
1890-1891.....	17 " 6 "	No record.	No record.
1891-1892.....	21 " 9 "	No record.	36 ft. 3 ins.
1892-1893.....	23 " 11 "	No record.	38 " 10 "
1893-1894.....	23 " 9 "	45 ft. 4½ ins.	No record.
1894-1895.....	16 " 4 "	28 " 11 "	No record.
1895-1896.....	27 " 8 "	No record.	No record.
1896-1897.....	10 " 2 "	34 ft. 11 ins.	No record.
1897-1898.....	No record.	27 " 6 "	No record.
1898-1899.....	18 ft. 11 ins.	43 " 2 "	No record.
1899-1900.....	18 " 10 "	26 " 9 "	20 ft. 0 ins.
1900-1901.....	17 " 10 "	32 " 1 "	34 " 11 "
1901-1902.....	19 " 3 "	28 " 6½ "	30 " 1 "
1902-1903.....	22 " 11 "	32 " 0 "	28 " 9 "
1903-1904.....	24 " 1 "	31 " 11 "	41 " 4 "
1904-1905.....	15 " 1 "	16 " 7 "	14 " 8½ "
1905-1906.....	14 " 3 "	22 " 0½ "	22 " 4½ "

Taking into account only the years in which records have been preserved gives the average snowfall at "Cut Bank," 19 feet 3 inches, Glacier House, 30 feet 10 inches, and "No. 18 Shed," 33 feet 8 inches, while the average yearly snowfall, taking into account all years observed since the winter of 1886, gives 27 feet 11 inches. On the higher slopes and the névé regions of the glaciers in the vicinity the snowfall is much greater, yet the above may be taken fairly as an average for the elevation of Glacier House, 4,120 feet, or a little below the tongue of the Illecillewaet Glacier.

In the following pages no attempt will be made to describe the peculiar phenomena of the several glaciers upon which measurements have been made, but to briefly outline the observations made during the last two weeks of July, 1906, together with sufficient description of the work which has gone before to provide data for comparisons.

## ILLECILLEWAET GLACIER.

## GLACIER HOUSE, BRITISH COLUMBIA.

Being the most accessible of any of this group, the Illecillewaet Glacier has been observed yearly since 1898. Prior to that time, beginning in 1887, the observations have been made with less regularity.<sup>1</sup>

The work may be divided under three heads, each of which will be treated separately as follows:

*Test Pictures.*—These have been made each year, beginning August 17, 1898, from the marked rock "W." From this point a complete view of the tongue and lower glacier may be had, and of a part of the icefall almost up to the limit of the dry glacier. The same camera and lens being used and exactly the same position selected, the pictures indicate very accurately the changes which have taken place in any given interval. A careful study of these shows that in spite of the continued recession of the tongue and a general shrinkage of the ice at the edges, particularly at the left side where great masses have broken away uncovering water-worn bedrock, the thickness of the ice at the sky line is appreciably thicker than it was in 1898. This condition has been noted for a number of years, and time alone will prove whether an advance will take place when the thicker mass reaches the icefall and tongue. There is no doubt, however, that in all other particulars—breadth, depth and extension of tongue—the glacier is at present from year to year decreasing. A comparison of the two test pictures of 1902 and 1906, reproduced herewith, with that made in 1898 (compare Plate V, *Proc. Acad. Nat. Sci. Phila.*, 1899) will show in detail the changes which have taken place.

*Recession of Tongue.*—As previously noted (*Proc. Acad. Nat. Sci. Phila.*, 1899, p. 124), the first accurate location of the tongue of the ice is to be found in a long flat boulder not far from the moraine of 1887 (S. on the map), lettered by unknown hands, "16 feet to nearest ice, '90." With this rock as a basis the glacier showed a retreat after eight years on August 17, 1898, of 452 feet.

From 1898 to the past summer (1906) the annual change has been determined from a rock (marked "C." on map) lying in the centre of the bed moraine and which on August 17, 1898, was 60 feet from the tongue of the ice. The following table shows the recession each year and the date on which the measurements were made.

<sup>1</sup> For detailed accounts of previous investigations on this glacier see *Proc. Acad. Nat. Sci. Phila.*, 1899, pp. 121 and 501, and 1901, p. 213.

*Illecillewaet Glacier, Recession of Tongue of Ice from Rock C.*

Date of Observation.	Distance Tongue of Ice to Rock C.	Recession of Ice since previous Year.
Aug. 17, 1898.....	60 ft.	
July 29, 1899.....	76 "	16 ft.
Aug. 6, 1900.....	140 "	64 "
Aug. 5, 1901.....	155 "	15 "
Aug. 26, 1902.....	203 "	48 "
Aug. 25, 1903.....	235 "	32 "
Aug. 14, 1904.....	240½ "	5½ "
July 25, 1905.....	243 "	2½ "
July 24, 1906.....	327 "	84 "

It is interesting to note that while the recession between 1890 and 1898 showed an average of 56 feet per year, for the eight years from 1898 to 1906 this average has been but 33.3 feet per year, or about three-fifths. It will also be observed, by reference to the map, that the measurement on July 24, 1906, was not made to the point of greatest extension in the ice. Should this point have been measured the course would not have been in the same line as previous years, the tongue having moved to the left, but the recession for the year ending in 1906 would have been 64 feet, instead of 84 feet as noted in the table.

The change noted between any two years is not a good indication of the amount of recession or advance which may have taken place, as the local weather conditions, rainfall, and even the condition of the crevasses above, all have a marked influence in determining changes, and it is only when these are eliminated by including a longer interval that the true amount of change may be determined.

*Flow of Glacier above Tongue.*—In 1899, to determine the rate of flow of the ice at a point about 1,300 feet above the tongue, eight plates were laid out across the glacier. These were accurately placed by means of a transit in a true line almost at right angles to the direction of flow, and their change in position accurately determined after stated intervals. The positions of these plates have been plotted on the map, and the table on page 572 gives a summary of the changes that have taken place at the times noted.

With the exception of the comparisons made between July 31 and September 5, 1899 (see first part of table, page 574), the motion indicates the movement of the glacier over the period of approximately a year, and thus includes both the summer flow which should be greater and the winter flow which should be less than the averages given.

Several of the 1899 plates have been lost from one cause or another,

## ILLECILLEWAET GLACIER.

Table Showing Motion of Line of Plates, 1899 to 1906.

Number of Plate.	Position of Plates on July 31, 1899.	Distance below original line on August 6, 1900.	Daily motion, 1899 to 1900.	Distance below original line on August 26, 1902.	Daily motion, 1900 to 1902.	Distance below original line on August 28, 1903.	Daily motion, 1902 to 1903.	Distance below original line on July 12, 1906.
1.....	On line.	1,044 ins.	2.82 ins.	3,456 ins.	3.21 ins.	Lost.	—	Lost.
2.....	On line.	1,488 ins.	4.00 ins.	4,446 ins.	3.94 ins.	Lost.	—	Lost.
3.....	On line.	1,716 ins.	4.64 ins.	4,848 ins.	4.18 ins.	6,216 ins.	3.73 ins.	On border moraine, 10,200 ins.
4.....	On line.	2,112 ins.	5.71 ins.	Lost.	—	Lost.	—	Lost.
5.....	On line.	2,220 ins.	6.00 ins.	5,850 ins.	4.84 ins.	7,740 ins.	4.87 ins.	Lost.
6.....	On line.	2,280 ins.	6.16 ins.	6,312 ins.	5.51 ins.	8,388 ins.	5.65 ins.	Lost.
7.....	On line.	2,160 ins.	5.84 ins.	6,504 ins.	5.79 ins.	Lost.	—	Lost.
8.....	On line.	2,040 ins.	5.51 ins.	Lost.	—	Lost.	—	Lost.

while others have completed their journey and now rest on the bowlders at the edge of the ice. In 1906 an entirely new set of six plates was prepared, and on July 12 they were laid out on the exact line used in 1899 (see map). Some defects having been found in the first plates the ones laid out this year were of different design. A lighter steel reduced the weight by one-half without decreasing efficiency, while the pipe caulk was dispensed with entirely, a hold in the ice being obtained by turning the right edge up one-half inch, and the left edge down a like amount. The plate was thus held in position on the ice should it turn over. It is made up of but one piece, and may be nested compactly for carrying. Steel one-eighth inch thick was used, 6 inches by 7 inches, which was left 6 inches square after the edging up had been completed. A trial showed that the thinner plate, allowing greater melting of the ice beneath, formed a pocket in which the plate rested, almost entirely free from slipping even on the steeper slopes. Each plate was marked "VAUX, 1906" in white on a red lead background. The plates laid out were numbered from 1 to 6, beginning on the right side of the glacier.

The aim of this investigation was to compare the yearly rate of flow at the line laid out with the yearly changes in the position of the tongue, and to determine the effect which a change in one would have on the other. As the second series of plates have been in position but a short time no yearly comparisons can be made, but the following table, comparing the daily motion of the plates in the fall of 1899 (compare *Proc. Acad. Nat. Sci. Phila.*, 1899, p. 507) with the motion of those in 1906, will give a ratio of the summer motion between the two dates. The plates have been grouped according to their location on the glacier, the numbers in the two instances bearing no relation to each other.

The great uncertainty of this work may be realized when it is noted that in 1906 during twelve days the surface conditions of the glacier changed completely. Crevasses opened, others closed, and plates which when laid out were on comparatively level ice were found to be in almost inaccessible positions, which took long détours from the main path to reach.

The interval between the laying out and measuring of the plates was one of unusual heat. Great freshets were reported all through the district, every glacier stream was swollen to abnormal size, and evidences of great surface melting were everywhere apparent.

In addition to locating the position of the plates, a cross-section of the surface of the glacier at this point was developed. A comparison

of this area with that similarly plotted in 1899 shows a marked shrinkage in the surface of the ice at that point.

*Table Comparing Summer Daily Motion of Plates on Illecillewaet Glacier. 1899-1906.*

1899—36-day interval.			1906—12-day interval.		
Number of Plate.	Feet from 1906 ice edge.	Average daily motion in inches.	Average daily motion in inches.	Feet from 1906 ice edge.	Number of Plate.
1	187	2.56	Plate lost.	92	1
2	415	3.90	7.00	276	2
3	520	5.51			
4	668	6.77	11.33	532	3
5	760	6.06	9.75	727	4
6	900	6.79			
7	956	6.16			
			10.25	1,020	5
8	1,220	6.00	8.85	1,171	6

#### ASULKAN GLACIER.

##### GLACIER HOUSE, BRITISH COLUMBIA.

This glacier, lying at the head of the Asulkan Valley, some three miles from Glacier House in British Columbia, has been observed with more or less regularity since 1899 (compare *Proc. Acad. Nat. Sci. Phila.*, 1899, p. 504). At that time rocks were marked and the general aspect of the tongue and moraines noted. Photographs have also been made which show the yearly changes in extension, thickness and breadth.

The work on this glacier in 1906 covered practically the same ground as on the Illecillewaet, and may be similarly divided.

*Test Pictures.*—An almost continuous record of photographs of the lower section has been made since 1899 from a large flat rock several hundred feet below the glacier which affords a view of all parts. A comparison of these photographs taken over a series of years shows smaller changes than in the cases of some of the neighboring glaciers, but that they are of the same character—a general shrinkage and reduction of section area (compare Plates XXV and XXVI with Plate VI, *Proc. Acad. Nat. Sci. Phila.*, 1899).



*Changes in the Tongue.*—On the left side the Asulkan Glacier is bearing a large amount of morainal material which is deposited at the lower part of the left edge and upon the tongue. The right side is comparatively free from moraine except stray erratics which are borne on the surface of the ice and deposited at the edge. Several small moraines on the bed moraine indicate that at one time the amount of this material was much greater than at present.

For several years the tongue has been deeply bedded in moraine and was difficult to locate. During the period of slight advance which was first noted in 1903 a steep moraine was pushed up at the tongue and the stream forced to find an exit through a smaller moraine on the right. The present year, however (1906), the tongue occupied almost exactly the same position as in 1899, leaving a space between the ice and the moraine which was formed during the glacier advance. A considerable stream issues directly beneath the tongue and almost covering the 1899 test rock, has broken through the high unstable moraine.

The following table shows the changes in the tongue as observed since 1899.

*Table Showing Changes in Tongue of Asulkan Glacier.*

Aug. 12, 1899.....	“Rock opposite lined with snout.”
Aug. 8, 1900.....	Snout receded 24 feet.
Aug. 6, 1901.....	Ice above rock 20 feet, 4 feet advance.
Aug. 30, 1903.....	Ice below rock 16 feet, 36 feet advance since 1901.
July 23, 1906.....	Ice lines with test rocks, or is in same position as in 1899.

*The Flow of Glacier above Tongue.*—For this work a line was selected across the glacier about 1,250 feet above the tongue and as nearly as possible at right angles to the line of flow. Owing to the comparatively short distances and the ease of observation no base line was laid down except as a check, and the positions of the plates from the points of observation were determined by means of the stadia. The motion of the plates on the ice was in every case measured with a horizontal steel tape at right angles to the base line. Plates numbered 7 to 12, similar to those used on the Illecillewaet Glacier, were laid out on July 13, 1906, and their motion determined on July 23. The following table shows the total and average daily motion of the plates and of a very large oblong boulder resting on the top of the moraine on the left edge of the glacier and advancing with it.

*Table Showing Average Daily Motion of Plates on Asulkan Glacier  
between July 13 and July 23, 1906.*

Plate.	Total Motion.	Average Daily Motion.	Remarks.
No. 7.....	24 in.	2.4 in.	Near right edge of ice.
No. 8.....	39 "	3.9 "	63 feet from R. edge.
No. 9.....	55½ "	5.5 "	157 feet from R. edge.
No. 10.....	67 "	6.7 "	325 feet from R. edge.
No. 11.....	67 "	6.7 "	415 feet from R. edge.
No. 12.....	63 "	6.3 "	Close to left edge.
Boulder .....	89 "	8.9 "	On left moraine, resting on icefoot.

*Sketch Map of Tongue.*—The accompanying map of the glacier foot has been compiled from a series of stadia measurements, sketches and photographs. On it have been plotted the position of the tongue and the outline of the ice as it existed on July 23, 1906. If question is raised as to the accuracy of the stadia method for this class of work, it may be noted that in every instance the motion of plates and recession were determined from measurements with a standard tape, and it was found that over rough ground and glacier surfaces work could be greatly expedited by use of the stadia, with an error not so great as would be encountered on the necessarily small scale of the plotting map.

#### WENKCHEMNA GLACIER.

##### VALLEY OF THE TEN PEAKS, LAGGAN, ALBERTA.

In some respects this glacier presents the most unusual aspect of any noted in the region. Of the piedmont type its névé receives snow which falls and is blown across the Wenkchemna Group or "The Ten Peaks" and falls into the couloirs and chimneys lying on the northern slopes. At the lower levels a number of comparatively small glaciers are formed, flowing almost due north across the southern half of the Valley of the Ten Peaks. The valley bottom in places is covered with an open forest of firs and spruces, the Lyell larch being found in abundance at the upper (western) end where an elevation of over 7,000 feet is reached.

At the head of the valley several almost parallel lines of ancient moraines were noted, and distinct traces of them could be followed down the valley till they were finally lost in the stream-eroded bottom. These moraines, and the very interesting one at the lower end of Moraine Lake which has given it its existence and name, point clearly to the

fact that the glacier at one time covered the entire bottom of the valley, and that the medial moraines which are now noted between the several sections of the glacier were at that time carried entirely on its back down the valley and deposited far below, without leaving any trace of the route which had been originally taken.

It has been known for a number of years that some portions of the Wenkchemna Glacier were advancing, or rather that from time to time masses of moraine which had rested almost upon the limit of the ice had been shot down upon and partly or completely covered living trees of the forest, which in places comes directly up to the ice wall. A comparison of photographs taken in previous years with the conditions as they were found in July, 1906, indicated that at the points in question no material advance of the ice could have taken place, and yet at these very points there was evidence of masses of moraine being projected on the ground below. The fresh rock was thrown beyond the limit of the ice, which to all observation had not changed recently. The base of the glacier close to the ground gave evidence of not having changed for a number of years, but from the ice slope above masses of rock were and had been precipitated *over* and beyond the older rocks and upon the grass and trees.

A careful consideration of these unusual conditions seemed to offer but one satisfactory solution. The ice forming this glacier, or rather composite glacier, is largely contained in a hollow or basin, from the bottom of which drainage is provided to the lake below. The ice extends above the edges of the basin, in many places covered deeply with moraine. The pressure upon the ice from behind causes a slow but steady motion of the upper strata towards the edges, which sets up a *shearing* action of one layer of ice on that below. The result is that the upper part of the moraine, very thin and unable to withstand the pressure, is pushed outward by the ice till it falls over the edge of the lower and more stable portions and upon the green grass or forest beyond the limits of the basin. It is evident that this action is much more active at certain points than at others, and an attempt was made to determine whether the position of the edge had anything to do with it, without satisfactory results.

Whatever may finally be determined as to the cause of change in the ice edge, a tramp over the glacier surface gave many evidences of great and continued shrinkage. The moraines everywhere showed that though they had been recently formed the ice was then many feet thicker, and a series of very beautiful rock cones, which rested on the solid ground but were surrounded by ice, bore silent witness to the

immense thickness of the ice in recent times compared with what is noted at present.

#### VICTORIA GLACIER.

##### LAKE LOUISE, LAGGAN, ALBERTA.

Almost as accessible as the Illecillewaet, the Victoria Glacier has never received the same careful study owing in large measure to the immense moraines which bury the tongue and the almost impossible task of finding permanent base and line ends. The great boulder marked in 1899, and which the next season had moved with the ice 147 feet, has not since been measured, but the position of the ice on the northwest side, referred to several large angular blocks of red quartzite, has been repeatedly determined.

During the summer of 1898 these blocks slipped from the ice and fell to the moraine below. On July 29, 1899, they were 20 feet from the ice; on July 24, 1900, 26 feet, showing a change of 6 feet for the year; on September 1, 1903, 76 feet 6 inches, or an average yearly shrinkage of almost 17 feet, while on July 30, 1906, the distance was but 74 feet 7 inches, showing practically no change, as the early date of measurement in 1906 compared with 1903 would make considerable difference in the total figures.

#### WAPTA OR YOHO GLACIER.

##### YOHO VALLEY, NEAR FIELD, BRITISH COLUMBIA.

This glacier, located at the head of the Yoho Valley, is a very long day's trip from Field, the station on the railway. On August 17, 1901, the position of the tongue was marked on a large mass of bedrock which had been recently uncovered by the ice. The tongue at this time was a narrow blade of ice somewhat to the left of the axis of the glacier and lying in a long deep groove between parallel ledges of rock. Three years later the change was measured on August 7, 1904, as 89 feet, or an average yearly recession of almost 30 feet. At this time there were signs of great activity and marked shrinkage.

On July 15, 1906, almost a month earlier in the season than on the occasion of the previous visit, the glacier was again observed and the distance measured as 76 feet 7 inches, or about  $12\frac{1}{2}$  feet less than in 1904. Allowing for the earlier date, it may be said that the tongue is in the same position as two years ago. The general aspect of the ice showed that it was shrinking and retreating, and this was particularly

the case on the right side where the main stream debouches from a most beautiful ice arch.

#### HORSESHOE GLACIER.

##### PARADISE VALLEY, LAGGAN, ALBERTA.

Although no marks have been placed on this glacier it offers some striking and unique points of interest. It is of the piedmont type and owes its existence to the snow avalanches from Mounts Hungabee, Ringrose, Lefroy and Mitre, to the north of which it lies. The tongue and lower portions are deeply buried in moraine. While in common with others there are indications of shrinkage and retreat, the protection of moraine on the surfaces renders these changes very slow. An exceedingly interesting phenomenon was noticed at a point several hundred feet above the tongue where a great sinuous cañon has been worn in the ice. The sides were perpendicular or overhanging, from 20 to 30 feet in depth, while the curves were 1,000 to 1,500 feet long. In all there were not less than ten great bends, and through the bottom a good-sized stream flowed. The walls exhibited very fine examples of banding, while all the surfaces were fluted horizontally, apparently due to the greater melting in summer than in winter. Should this be correct the cañon has been at least twelve years in forming.

From the foregoing data it is hard to draw more than the most general conclusions. It may, however, be safely noted that in all the glaciers observed there has been decided shrinkage and recession in the past seven years. While changes in the position of the tongue may have been small, the ice mass and sectional area are evidently much less. On the other hand the average yearly recession was in 1906 less than during a similar period five years before, the exception in the Illecillewaet Glacier being probably due to unusual conditions. The trifling advances in the Asulkan Glacier may be attributed to local causes and have no particular significance, but the increased daily rate of flow of the Illecillewaet, coupled with a thickening of the ice at the sky line as seen from the test rock, would seem to point to a period of greater activity in the not very distant future.

The following reports were ordered to be printed:

#### REPORT OF THE RECORDING SECRETARY.

Sixteen meetings of the Academy were held during the past year, with an average attendance of fifty-two. Communications, for the most part illustrated with lantern views, were made by Henry Skinner, George Vaux, Jr., William S. Vaux, Jr., Stewardson Brown, Arthur Erwin Brown, Witmer Stone, John W. Harshberger, William P. Wilson, Edwin G. Conklin, Henry Leffman, Benjamin Sharp, George Wood, Henry E. Wetherill, Harvey M. Watts, Mrs. Charles Schaeffer and Miss Mary J. Holmes. But few of these were reported for publication in the PROCEEDINGS.

Twenty-seven papers were presented for publication as follows: Henry W. Fowler, 5; J. Percy Moore, 4; James A. G. Rehn, 3; James A. G. Rehn and Morgan Hebard, 1; Henry A. Pilsbry, 2; Henry A. Pilsbry and C. M. Cook, Jr., 1; Benjamin C. Tilghman, 1; E. A. Andrews, 1; Ralph V. Chamberlain, 1; N. M. Stevens and A. M. Boring, 1; Burnett Smith, 1; Henry C. Oberholser, 1; J. F. McClendon, 1; R. J. Lechmere Guppy, 1; N. E. McIndoo, 1; W. S. Blatchley, 1; Nathan Banks, 1. Three of these were returned to the authors, the others were accepted for publication in the PROCEEDINGS, of which one number for 1905 and two for 1906 have been issued and distributed.

Seven hundred and fifteen pages of the PROCEEDINGS have been published, illustrated by fifteen plates. The Entomological Section has published four hundred and four pages with fifteen plates of the ENTOMOLOGICAL NEWS and two hundred and forty-seven pages with five plates of the TRANSACTIONS OF THE AMERICAN ENTOMOLOGICAL SOCIETY (Entomological Section of the Academy). Two hundred and seventy-two pages with thirty-four plates have been issued of the MANUAL OF CONCHOLOGY. This makes a total of sixteen hundred and thirty-eight pages and sixty-nine plates published during the year under the auspices of the Academy.

The President was appointed to represent the Academy at the celebration by the American Philosophical Society of the two hundredth anniversary of the birthday of Benjamin Franklin.

A satisfactory design for the new Hayden Memorial Medal has at last been submitted and approved. The artist has been engaged on the work since September, 1905. Whether the time that has elapsed

has been due to the eccentricities of the artistic temperament or a press of other engagements is not known, but it is believed that the beauty of the result will compensate for the delay. The new medal will certainly be a great improvement on the one awarded since 1890, the portrait of Hayden on the obverse being much more accurate than could have been hoped for from the photographs available, while the design of the reverse, replacing the unsatisfactory view of the Grand Cañon, is gracefully emblematic. The die will, it is hoped, be promptly engraved, so that the medal, so long due, may be conveyed to Dr. Walcott.

Mr. Fox has rendered effective assistance in the issue and distribution of the PROCEEDINGS.

EDWARD J. NOLAN,  
*Recording Secretary.*

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#### REPORT OF THE CORRESPONDING SECRETARY.

During the past year the deaths of the following correspondents were announced from the chair: Baron C. R. von der Osten-Sacken, *Elisée F. Reclus*, Prof. Eugène Renevier, Dionys Stur, and Dr. Henry A. Ward. No correspondents were elected.

Notices of the deaths of seven scientific men of prominence were received and suitably acknowledged in letters of condolence.

There were received invitations to participate in the Tenth International Geological Congress, the International Congress for the Study of Polar Regions, the First International Congress of Oceanography, the Fifth International Congress of Obstetrics and Gynæcology, the Pre-historic Congress of France, the Congress of the Latino-Slavic League, the celebration of the Fiftieth Anniversary of the foundation of the Academy of Science of St. Louis, the celebration of the Two Hundredth Anniversary of the birth of Benjamin Franklin and the Dedication of the Engineering Building of the University of Pennsylvania. Except to the last two, no delegates were appointed by the Academy. The invitations were acknowledged by appropriate expressions of interest and regret or congratulation. At the last two gatherings the Academy was represented by its President, on behalf of whom also the Corresponding Secretary accepted his appointment by the Society of Physical and Natural Sciences of Bordeaux as delegate to the Franklin celebration.

A number of circulars announcing changes in the organization or staffs were received from learned societies and museums, and various

requests for information or courtesies were answered or referred to the proper officers of the Academy.

The following table summarizes the correspondence for the year:

#### COMMUNICATIONS RECEIVED.

Acknowledging receipt of the Academy's publications, . . . . .	166
Transmitting publications, . . . . .	65
Requests for the supply of deficiencies, . . . . .	2
Invitations to learned gatherings, . . . . .	12
Announcements of deaths of scientific men, . . . . .	9
Circulars concerning the administration of scientific institutions, etc., . . . . .	10
Photographs of correspondents, . . . . .	11
Biographies of correspondents, . . . . .	8
Letters from correspondents, . . . . .	7
Miscellaneous letters, . . . . .	36
Total received, . . . . .	326

#### COMMUNICATIONS FORWARDED.

Acknowledging gifts to the Library, . . . . .	860
Acknowledging gifts to the Museum, . . . . .	55
Acknowledging photographs and biographies, . . . . .	14
Requesting the supply of deficiencies in journals, . . . . .	68
Letters of sympathy and congratulation, . . . . .	8
Miscellaneous letters, . . . . .	64
Copies of annual reports and circulars, . . . . .	326
Total sent, . . . . .	1,395

Respectfully submitted,

J. PERCY MOORE,  
*Corresponding Secretary.*

#### REPORT OF THE LIBRARIAN.

The Library of the Academy has been increased by the following additions during the past year:

Pamphlets and parts of periodicals, . . . . .	5,715
Volumes, . . . . .	1,157
Maps, . . . . .	146
Photographs, . . . . .	33
Manuscript, . . . . .	1
Total, . . . . .	7,052



They were received from the following sources:

Societies.....	2,290	Dr. William P. Wilson.....	5
I. V. Williamson Fund.....	2,397	Commission de la Belgica.....	5
Editors.....	647	Imperial Geological Survey, Japan.....	5
General Appropriation.....	340	Trustees of British Museum.....	5
United States Department of Agriculture.....	315	Department de l'Agriculture aux Indes Néerlandaises.....	5
United States Department of the Interior.....	250	Iowa Geological Survey.....	5
Authors.....	122	James F. Jones.....	5
James Aitken Meigs Fund.....	111	Department of the Interior, Canada.....	4
Edward Robins.....	106	Government of India.....	4
Department of Mines, Western Australia.....	41	Department of Mines, New South Wales.....	4
Mrs. Charles Schaeffer.....	38	Dr. J. Solis Cohen.....	4
Wilson Fund.....	27	Instituto Geologico de Mexico.....	4
Dr. H. C. Chapman.....	21	Geological Survey of Canada.....	4
Ministerio de Fomento, Peru.....	16	Geological Survey of India.....	4
University of Chicago.....	14	Bureau of American Ethnology...	3
United States Department of Commerce and Labor.....	13	Clarence B. Moore.....	3
Department of the Interior, Philippines.....	13	William J. Fox.....	3
Cape of Good Hope, Department of Agriculture.....	12	Publication Committee, Acad- emy.....	3
Swedish Government.....	12	Dr. Thomas Biddle.....	3
Department of Mines, Pennsylv- ania.....	12	Dr. Edward J. Nolan.....	3
United States Treasury Depart- ment.....	10	State Geological Survey, North Dakota.....	3
United States War Department...	10	New Zealand Government.....	3
Pennsylvania State Department of Agriculture.....	10	Commissão do Serviço Geologico de Portugal.....	3
Henryk Arctowski.....	10	Albert I de Monaco.....	2
Department of Agriculture, Jamaica.....	10	Ethnological Survey of Philip- pines.....	2
Facultad de Agronomia y Veteri- naria, La Plata.....	9	Université Catholique de Louvain	2
Ministère des Travaux Publics, France.....	8	Geological and Natural History Survey of Wisconsin.....	2
Dr. J. W. Harshberger.....	8	Department of Mines and Agri- culture, Sydney.....	2
Henry A. Pilbry.....	8	Duc de Loubat.....	2
Sveriges Geologiska Undersök- ning.....	8	Commissioners of Fisheries and Game (Massachusetts).....	2
Geological Survey of New Jersey..	7	Department of Agriculture of India.....	2
James A. G. Rehn.....	7	Department of Mines, Victoria....	2
Biblioteca Nacional, Bogota.....	6	United States Fish Commission...	1
Library of Congress.....	5	United States Coast and Geodetic Survey.....	1

United States Public Health and Marine Hospital Service.....	1	Geological and Natural History Survey of Minnesota.....	1
Dr. W. W. Keen.....	1	Royal South African Co.....	1
Samuel Wagner.....	1	State Earthquake Investigation Commission, California.....	1
Commission Géologique, Finland.....	1	Board of Scientific Advice for India.....	1
Public Library of Victoria.....	1	Pennsylvania Department of Fisheries.....	1
Maryland Geological Survey.....	1	Dr. Zawadny.....	1
Alabama Geological Survey.....	1	North Carolina Geological Survey	1
Gouvernements Kina-Ondernem- ingen, Java.....	1	Dr. Benjamin Sharp.....	1
Commission Géodesique Néer- landaise.....	1	Illinois Bureau of Labor Statis- tics.....	1
Thomas L. Montgomery.....	1	Department of Geology and Nat- ural History, Indiana.....	1
Department of Mines, Nova Scotia.....	1	Council of the Fridtjof Nansen Fund for the Advancement of Science.....	1
Imperial Department of Agricul- ture, Calcutta.....	1	Geological Commission, Cape of Good Hope.....	1
Missouri Bureau of Geology and Mines.....	1	Biologisches Anstalt, Helgoland.	1
Home Secretary's Department, Queensland.....	1		
Angelo Heilprin.....	1		
Trustees of the Indian Museum.....	1		

They were distributed to the several departments of the Library as follows:

Journals.....	5,211	Anthropology.....	28
Geology.....	355	Helminthology.....	27
Agriculture.....	323	Bibliography.....	24
Botany.....	267	Ichthyology.....	20
General Natural History.....	182	Mammalogy.....	15
Geography.....	152	Physical Sciences.....	12
Voyages and Travels.....	103	Medicine.....	11
Ornithology.....	58	Herpetology.....	8
Entomology.....	54	Mineralogy.....	8
Anatomy and Physiology.....	40	Chemistry.....	1
Conchology.....	32	Miscellaneous.....	21

The general condition of the Library has been further improved by the binding of 2,010 volumes. It is hoped that in a year or so the arrearages will have received such attention that the appropriations for bindings may be largely decreased.

In compliance with the action of the Council of the Academy, 1,318 volumes were sent to the California Academy of Sciences to assist in repairing the loss inflicted by earthquake and fire on the 18th of last April. The collection included a nearly complete set of the PROCEED-

INGS and JOURNAL of the Academy bound and, in common with the other volumes, appropriately labelled so as to indicate the source and object of the gift. A letter of acknowledgment recently received conveys the assurance that the books will be an important assistance to the California Academy, the members of which, in common with all the people of San Francisco, displayed such superb courage and fortitude under an almost overwhelming affliction. The boxes were sent to California through the Smithsonian Institution.

Many duplicates received from corresponding societies had for years been accumulating in the Library of the Academy. After a selection had been sent to the California Academy, the Library Committee and the Council directed the return of the remainder to the publishing societies, in the hope that a similar favor might be secured in the case of duplicates of the Academy's publications.

Parcels therefore have been sent through the International Bureau of Exchange to 215 societies, each accompanied by the following notice: "The Academy of Natural Sciences of Philadelphia returns duplicates of publications received from corresponding societies, and requests that duplicate numbers of its JOURNAL and PROCEEDINGS be returned, either by post or through the International Bureau of Exchange." It is hoped that this action may result in an addition to the stock of the earlier issues of the Academy's publications, several of which are nearly out of print.

Seventy-eight volumes and 256 pamphlets, publications of the Department of Agriculture, U. S. Geological Survey, Bureau of Education, etc., have been returned to the Government Printing Office, in compliance with the law. The greater number of these were duplicates, but some were works not pertinent to the Academy's Library. About thirty-seven volumes belonging to the latter class were given to the Free Library of Philadelphia.

Cards have been prepared to be placed in the spaces left by books kept in the study rooms for use, thus in a measure remedying the inconvenience arising from such retention.

The necessity for additional room in some of the departments of the Library becomes annually more pressing. In view of the possibility of an increase of the Academy's building in the near future certain of the additions are placed temporarily, not always in conformity with the system of classification, in the hope that the required increase in the shelving capacity of the Library may be secured.

Ten cases are still to be shelf-listed in the department of *Journals and Periodicals*, although the work has continued during the year as steadily as the time at the disposal of the Assistant would permit.

Three hundred and thirty-nine lantern slides have been added to the collection as a loan from the Ludwick Institute. These are distinguished in the catalogue by blue cards.

The intelligence and reliability of my assistant, William J. Fox, in the discharge of his duties, both in the Library and in connection with the publications of the Academy, are again gladly acknowledged.

EDWARD J. NOLAN,  
*Librarian.*

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### REPORT OF THE CURATORS.

The collections in the care of the Curators are in excellent condition, while much progress has been made during the year in their study and classification.

Early in the year work was begun upon the new concrete and steel roof for the Library building, for which the Academy received an appropriation of \$20,000 from the State of Pennsylvania, and by the beginning of the autumn it had been completed. The new roof is a needed improvement, being thoroughly waterproof and fireproof, while it admits an abundance of light to the Museum galleries.

This work necessitated the temporary closing of the old Museum to the public and the removal of all the collections from the upper gallery, while the cases on the lower floor had to be boarded up for their better protection. The rearrangement of the collections is now in progress and will be pushed rapidly during the coming year.

Two thousand and sixteen cubic feet of exhibition cases uniform with those previously installed have been ordered for birds, invertebrate fossils and the McCook collection of insect architecture.

A number of air-tight metal storage cases have been provided for the bird and mammal skins and for the Herbarium.

Mr. Clarence B. Moore has continued his exploration of the Indian mounds of the Gulf States and has still further enriched his unrivalled collection.

Through the liberality of Mrs. Charles Schaeffer, Mr. Stewardson Brown was enabled to spend two months collecting botanical specimens in the Canadian Rockies, where he obtained about 4,000 plants representing 700 species.

Dr. Henry Skinner visited Idaho in the interest of the Academy for

the purpose of making entomological collections, but a serious attack of illness materially interfered with his work.

Dr. H. A. Pilsbry spent October and November in the prosecution of his studies on the molluscan fauna of Arizona.

In addition to these extended expeditions many local collecting trips have been undertaken by the members of the Museum staff and much valuable material secured.

Among the more notable accessions to the Museum during the year may be mentioned the Gulick collection of Hawaiian mollusks, which formed the basis of Mr. Gulick's well-known paper on "Evolution, Racial and Habitudinal"; the collection of bird skins formed by the late Canon Tristram, of Durham, England, representing over 3,000 species from all parts of the world, a large proportion of them new to the Academy's collection; and another valuable collection of marine invertebrates from Naples, presented by Dr. Henry C. Chapman.

A number of valuable mammals received from the Zoological Society of Philadelphia or by purchase have been mounted by the taxidermist and many others prepared as skins or skeletons. Considerable additions have been made to the alcoholic series in Herpetology.

In addition to the services rendered by the Museum staff the Curators are indebted to Dr. P. P. Calvert, Messrs. E. T. Cresson, Jr., and H. W. Wenzel for aid in the Entomological department, and to Mr. S. S. Van Pelt in the Herbarium.

Details of the year's work in several departments are appended. In addition Dr. J. P. Moore has continued the care and study of the Helminthological collections, and Mr. H. W. Fowler of the Fishes, while Miss H. N. Wardle has made progress in cataloguing and arranging the Archæological collections.

The Anti-Tuberculosis Society, Philadelphia Botanical Club, and Delaware Valley Ornithological Club have held their meetings in the Academy during the year. The collections have been consulted by many visiting scientists and specimens have been loaned to Robert Ridgway, H. W. Henshaw, H. I. Smith, C. Hart Merriam, D. G. Elliot, M. W. Lyon, H. F. Osborn, E. B. Williamson, Frank Stephens, G. W. Clapp, A. N. Caudell, O. P. Hay, O. A. Peterson, G. S. Miller, Jr., F. C. Baker, Lawrence Bruner, Earl Douglass, and E. W. Nelson.

SAMUEL G. DIXON,  
*Curator.*

#### REPORT OF THE SPECIAL CURATOR OF THE DEPARTMENT OF MOLLUSCA.

Early in the year the entire collection of mollusks was removed from  
nained packed up during the construction

of the new roof of the Museum. New cases have now been ordered, which will enable us to rearrange the specimens during the coming year. Meanwhile work has been continued upon such parts of the collection as were accessible.

Large accessions have been received from numerous correspondents of the Curator. A list of these gifts may be found in the accessions to the Museum. The largest single accession has been the collection of Hawaiian land snails purchased from Dr. John T. Gulick. This series served as the basis of that author's important studies on evolution, as well as his systematic papers on the Hawaiian fauna. Mr. H. Bloomfield Moore has contributed largely to our series of small land mollusks of Georgia and Florida by gatherings of leaves and humus, from which large numbers of shells have been picked by Mr. Vanatta.

The Special Curator has been occupied chiefly with the preparation of the *MANUAL OF CONCHOLOGY*, the monograph of the family *Achatinidae* being completed this year, and the collections of this group revised and relabelled. Studies of American and Japanese mollusks have also been continued. The months of October and November were spent in Arizona and New Mexico, chiefly in the Grand Canyon of the Colorado, the Florida and Chiricahua Mountains, and large collections of the mollusca of these regions were obtained.

Mr. E. G. Vanatta has continued his efficient work as Assistant in the department throughout the year.

H. A. PILSBRY,  
*Special Curator.*

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## REPORTS OF THE SECTIONS.

### THE BIOLOGICAL AND MICROSCOPICAL SECTION.

The Section has held nine stated and several informal meetings with the usual attendance.

The donations reported by the Conservator are as follows: One Zentmayer histological microscope with three objectives; one Fiddian and one Acme microscope lamp; about 400 slides, including two Möller type plates and an arranged monogram mount by Thum; about twenty-five books, including Van Heurck's *Diatoms of Belgium*, the *Micrographic Dictionary*, and a lot of unmounted material and mounting apparatus. All the above are from the collection of the late John C. Wilson, presented by Miss Maria S. Wilson.

Five slides of marine invertebrates, collected by Dr. Chapman and mounted by the Conservator.

At the regular meetings numerous communications have been made by the members on such subjects as rock inclusions, Diatoms, Myxomycetes and Bacteria.

There has been a slight increase in membership.

The officers elected for the year 1907 are as follows:

<i>Director,</i>	J. Cheston Morris, M.D.
<i>Vice-Director,</i>	T. Chalkley Palmer,
<i>Treasurer,</i>	Thomas S. Stewart, M.D.
<i>Recorder,</i>	Charles S. Boyer.
<i>Conservator,</i>	F. J. Keeley.
<i>Corresponding Secretary,</i>	Silas L. Schumo.

CHARLES S. BOYER,  
*Recorder.*

#### MINERALOGICAL AND GEOLOGICAL SECTION.

Nine meetings of the Mineralogical and Geological Section were held during the year with a fair attendance, and the finances of the Section are in good condition. Seven excursions were made to interesting localities and proved to be enjoyable to all who participated in them, as well as an agreeable method of study and recreation. There was an average attendance on these occasions of about 30.

At the annual meeting held December 17, 1906, the following officers were elected:

<i>Director,</i>	Benjamin Smith Lyman.
<i>Vice-Director.</i>	George Vaux, Jr.
<i>Treasurer,</i>	Emma Walker.
<i>Recorder,</i>	Mary S. Holmes.
<i>Conservator,</i>	Frank J. Keeley.

Respectfully submitted,

GEORGE VAUX, JR.,  
*Vice-Director.*

#### THE ENTOMOLOGICAL SECTION.

The regular monthly meetings have been held, except during July and August, with an attendance of 11 persons. The proceedings of the Sec-

tion have been published in the ENTOMOLOGICAL NEWS. Volume XVII of this journal has been completed with 404 pages and 15 plates. The number of authors contributing articles was 92. Two thousand two hundred and seventeen insects were added to the collection. Nearly all of these have been properly incorporated in the cabinets. The number added this year has not been as great as in the two previous years, but there have been a number of valuable types presented and many gaps filled. The more important additions were 460 insects of various orders from P. P. Calvert; 305 Pennsylvania and New Jersey specimens with accurate data; 175 from Arizona, H. A. Pilsbry; collections from Mexico and the Western States from Henry Skinner; a collection from Minnesota, Witmer Stone; a valuable lot of mosquitoes from New Jersey, H. L. Viereck; blind *Carabidæ* from caves in Europe, H. W. Wenzel, and a small collection from Panama from H. E. Wetherill. The efficiency of the metal case or cabinet has been further demonstrated during the past summer. Some insects kept in wooden cases were damaged by mould, owing to the excessive dampness and leakage of the temporary roof on the building. At a meeting held December 27, the following officers were elected to serve for 1907:

<i>Director,</i>	.	.	.	.	.	.	Philip Laurent.
<i>Vice-Director,</i>	.	.	.	.	.	.	H. W. Wenzel.
<i>Treasurer,</i>	.	.	.	.	.	.	E. T. Cresson.
<i>Recorder,</i>	.	.	.	.	.	.	Henry Skinner.
<i>Secretary,</i>	.	.	.	.	.	.	J. H. Ridings.
<i>Conservator,</i>	.	.	.	.	.	.	Henry Skinner.
<i>Publication Committee,</i>	.	.	.	.	.	.	} J. H. Ridings, { E. T. Cresson.

HENRY SKINNER,  
*Recorder.*

#### THE BOTANICAL SECTION.

During the past year the work of placing the specimens in species covers was begun, the work in more than half of the Herbarium being completed to date; the balance will be arranged in the early part of the coming year.

Additions to the Herbarium have numbered about 9,000 sheets; of these we have received as an exchange from the New York Botanical Gardens of about 1,100, including a set of 899 sheets of Dr. Abrams' Southern California plants, 87 sheets from Central America and the



West Indies and 100 *Characeæ* from the herbarium of the late Dr. T. F. Allen.

Specimens have been presented by Dr. Ida A. Keller and Messrs. Joseph Crawford, Charles S. Williamson, Bayard Long, Benjamin H. Smith, Stewardson Brown, Samuel S. Van Pelt, Dr. John W. Harshberger, Witmer Stone and the Philadelphia Botanical Club, from various parts of the eastern United States, amounting to about the same number.

The Section has purchased the following: From Mr. A. A. Heller, 2,400 Californian plants; from Dr. Charles H. Shaw, 545 British Columbian plants; from A. O. Garrett, 100 Utah plants; from Dr. J. W. Blankinship, 583 Montana plants.

Through the liberality of Mrs. Charles Schaeffer, the Conservator was enabled to spend the months of June and July collecting in the Canadian Rocky Mountains, in the provinces of Alberta and British Columbia. More than 4,000 specimens were made, covered by over 800 numbers. Several sets of duplicates of this collection will be available for exchange.

Valuable assistance has been rendered by Miss Ada Allen in mounting specimens and Francis W. Pennell in cataloging and arranging same.

The Philadelphia Botanical Club has continued to hold its meetings at the Academy during the year, about 1,800 sheets having been added to the local Herbarium, which has been assiduously cared for by Mr. Samuel S. Van Pelt, its curator.

At the annual meeting of the Botanical Section the following were elected to serve as its officers for the coming year:

<i>Director,</i>	Benjamin H. Smith.
<i>Vice-Director,</i>	Joseph Crawford.
<i>Recorder,</i>	Charles S. Williamson.
<i>Treasurer and Conservator,</i>	Stewardson Brown.

Respectfully submitted,

STEWARDSON BROWN,  
*Conservator.*

#### THE ORNITHOLOGICAL SECTION.

During the past year the remainder of the mounted birds, with the exception of the song birds and ostriches, were removed to the new building and placed in the cases provided for them, all of the specimens

being examined by the taxidermist and thoroughly cleansed. Three new cases to accommodate the groups above mentioned are now nearly completed, so that the arrangement of the new bird gallery will be finished at an early date.

Ten additional cases have been procured for the study series of skins, which is increasing at a rapid rate and is much consulted.

During the past year the Academy secured by purchase the collection of bird skins belonging to the late Canon Tristram, of Durham, England. This comprises about 7,000 specimens, representing some 3,000 species, the avifauna of British Guiana and of various insular groups being particularly well represented. Altogether it forms one of the most notable accessions that has been made to the Ornithological department and brings the total number of specimens in the Academy's collection close to 55,000, while it adds a large number of forms previously unrepresented in our series.

Several nests and sets of eggs have been added to the Delaware Valley Ornithological Club Collection, rendering this local exhibit still more nearly complete.

The Club has held its meetings in the building of the Academy during the year, and its members, as well as many visiting ornithologists, have studied the collections.

Mr. J. A. G. Rehn has rendered important service during the year in cataloguing and arranging the accessions.

At the annual meeting of the Section the following officers were elected:

<i>Director,</i>	.	.	.	.	.	Spencer Trotter, M.D.
<i>Vice-Director,</i>	.	.	.	.	.	George Spencer Morris.
<i>Secretary,</i>	.	.	.	.	.	William A. Shryock.
<i>Recorder,</i>	.	.	.	.	.	Stewardson Brown.
<i>Treasurer and Conservator,</i>	.	.	.	.	.	Witmer Stone.

WITMER STONE,  
*Conservator.*

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The annual election of Officers, Councillors and Members of the Committee on Accounts to serve during 1907 was held with the following result:

PRESIDENT, . . . . .	Samuel G. Dixon, M.D.
VICE-PRESIDENTS, . . . . .	Arthur Erwin Brown, Edwin G. Conklin, Ph.D.
RECORDING SECRETARY, . . . . .	Edward J. Nolan, M.D.
CORRESPONDING SECRETARY, . . . . .	J. Percy Moore, Ph.D.
TREASURER, . . . . .	George Vaux, Jr.
LIBRARIAN, . . . . .	Edward J. Nolan, M.D.
CURATORS, . . . . .	Arthur Erwin Brown, Samuel G. Dixon, M.D., Henry A. Pilsbry, Sc.D., William S. Vaux, Jr.
COUNCILLORS TO SERVE THREE YEARS, . . . . .	Dr. C. Newlin Peirce, Philip P. Calvert, Ph.D., Thomas Biddle, M.D., Frederick Prime.
COMMITTEE ON ACCOUNTS, . . . . .	Charles Morris, Samuel N. Rhoads, Dr. C. Newlin Peirce, John G. Rothermell, Howard Crawley, Ph.D.
COUNCILLOR TO SERVE AN UNEXPIRED TERM OF TWO YEARS, . . . . .	Henry Tucker, M.D.

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#### COUNCIL FOR 1907.

*Ex-officio.*—Samuel G. Dixon, M.D., Edwin G. Conklin, M.D., Arthur Erwin Brown, Edward J. Nolan, M.D., J. Percy Moore, Ph.D., George Vaux, Jr., Henry A. Pilsbry, Sc.D., and William S. Vaux, Jr.

*To serve Three Years.*—Dr. C. Newlin Peirce, Philip P. Calvert, Ph.D., Thomas Biddle, M.D., and Frederick Prime.

*To serve Two Years.*—Charles B. Penrose, M.D., Charles Morris, Benjamin Sharp, M.D., and Henry Tucker, M.D.

*To serve One Year.*—Thomas Fenton, M.D., Edwin S. Dixon, John Cadwalader and Horatio C. Wood, M.D.

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CURATOR OF MOLLUSCA, . . . . .	Henry A. Pilsbry, Sc.D.
ASSISTANT LIBRARIAN, . . . . .	William J. Fox.

ASSISTANTS TO CURATORS, . . . . .	Witmer Stone, Henry Skinner, M.D., Stewardson Brown, J. Percy Moore, Ph.D., Edward G. Vanatta, Henry W. Fowler, J. A. G. Rehn, H. Newell Wardle.
TAXIDERMIST, . . . . .	David McCadden.
Jessup Fund Students, . . . . .	H. Newell Wardle, J. A. G. Rehn, Francis Pennell.
Janitors, . . . . .	Charles Clappier, Daniel Heckler, James Tague, Jacob Aebley.

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### ELECTIONS DURING 1906.

#### MEMBERS.

*January 16.*—Herbert S. Jennings, Ph.D., Rob't Grier LeConte, M.D.,  
Henry Leffman, M.D.

*February 20.*—R. E. B. McKenney, D. H. Tennant, Edward S. Miles.

*March 20.*—Francis William Rawle.

*April 17.*—Oglesby Paul, Norton Downs, M.D.

*May 15.*—Walter F. Herzberg.

## ADDITIONS TO MUSEUM.

## MAMMALS.

COL. GEORGE S. ANDERSON. Fruit Bat (*Pteropus* sp.), Civet Cat (*Viverra zangalunga*), Luzon, Philippines.

P. P. CALVERT. Two skulls of *Lepus*, Chihuahua, Mexico.

W. S. DICKINSON. Skull of melanistic Marsh Hare.

J. G. DILLIN. *Putorius noveboracensis*, Bucks county, Pennsylvania.

W. O. EMERSON. Five skins of mammals, California.

HOWARD FUGUET. Grevy's Zebra (*Equus grevyi*).

GEORGE L. HARRISON, JR. Water Buck (*Kobus*), Red Buck (*Cervicapra*).

DAVID MCCADDEN. Woodchucks (*Marmota monax*), Chester county, Pennsylvania. Old and young. Fetus of Gray Squirrel.

MEDICO-CHIRURGICAL COLLEGE. Several mammalian embryos.

C. J. PENNOCK. European Ferret.

PURCHASED. Mink (*Putorius vison*), New Jersey.

S. N. RHODS. Bonaparte's Weasel (*Putorius cicognani*).

BURNETT SMITH. Bull Dog, for skeleton.

H. L. VIERECK. Brown Bat (*Vespertilio fuscus*).

C. L. WILSON. Four Black Rats (*Mus rattus*), Glenolden, Pennsylvania.

ZOOLOGICAL SOCIETY OF PHILADELPHIA. Specimens prepared as follows:  
Mounted: Antelope Kangaroo (*Macropus antilopenus*), Ratel (*Mellivora indica*), Lioness (*Felis leo*). Skin and skull: Beaver (*Castor fiber*), Himalayan Bear (*Ursus tibetanus*), Panda (*Aelurus fulgens*), Ocelot (*Felis pardalis*), Arabian Gazelle (—), Florida Otter (*Lutra hudsonica vaga*), Central American Puma (*Felis concolor costaricensis*). Skin: Eyra Cat (*Felis eyra*). Skull: Young Steller's Seal (*Eumetopias stelleri*). Skeleton: Binturong (*Arctictis binturong*).

## BIRDS.

COL. GEORGE S. ANDERSON. Twelve skins of Philippine birds and egg of *Megapode*.

C. F. BAKER. Skin of *Icterus hypomelas*, Cuba.

DR. C. BERENS. Goshawk (*Astur atricapillus*), Cape May, New Jersey.

DELAWARE VALLEY ORNITHOLOGICAL CLUB. Six nests and eggs of local birds for the D. V. O. C. Collection.

GEORGE L. HARRISON, JR. Eggs of Maribou Stork, boundary of Soudan and Abyssinia.

PURCHASED. H. B. Tristram collection of bird skins and mounted birds, about 7,000 specimens.

W. E. D. SCOTT. *Trochalopteron canorum*, skin.

EDWARD SINGLETON. Herring Gull (*Larus argentatus*), mounted.

ZOOLOGICAL SOCIETY OF PHILADELPHIA. Skins of *Spindalis pretrei*, *Conurus vagleri*, *Rhamphastos ambiguus*, *Turtur turtur risoria*, *Lagonosticta larvata*, *Buteo*

*albicaudata*, *Goura victoria*. Skeleton of *Sagittarius serpentarius*. Egg of *Callocephalon galeatum*.

#### REPTILES AND BATRACHIANS.

- DR. C. C. ABBOTT. Snake.  
 R. C. ABBOTT. Green Snake, Vermont.  
 ARTHUR ERWIN BROWN. Thirty-seven jars of Reptiles and Batrachians.  
 P. P. CALVERT. Horned Toad (*Phrynosoma*), Chihuahua, Mexico.  
 DR. D. M. CASTLE. Two *Anolis principalis*, Tybee Island, Georgia.  
 C. H. CONNER. Two eggs of Water Turtle, Union Mills, New Jersey.  
 J. W. CORRISTON. Horned Toad (*Phrynosoma*).  
 HOWARD CRAWLEY. Tadpoles of *Rana palustris*.  
 H. W. FOWLER. Collections of Batrachia from various points in Pennsylvania and New Jersey. Red-bellied Terrapin, Dennisville, Cape May county, New Jersey.  
 H. W. FOWLER and T. D. KEIM. *Kinosternon* from Neshaminy Creek and collection of Reptiles and Batrachians from Potter county, Pennsylvania.  
 H. W. FOWLER and WITMER STONE. Collection of Reptiles and Batrachians, York Furnace, York county, Pennsylvania.  
 MEDICO-CHIRURGICAL COLLEGE. Several Reptiles.  
 FRANCIS PENNELL. *Rana clamata* and *catesbiana*, *Acris gryllus* and *Plethodon*, Wawa, Delaware county, Pennsylvania.  
 S. N. RHOADS. *Acris gryllus*, Nockamixon, Pennsylvania.  
 C. F. SANDS. Ground Rattlesnake, Kansas.  
 O. P. SATTERTHWAITE. Milk Snake, *Ophibolus g. doliatius*, Wawa, Pennsylvania.  
 S. L. SHUMO. Young *Terrapene carolina*, Glenmoor, Chester county, Pennsylvania.  
 DR. H. SKINNER. Three Lizards, Idaho.  
 WITMER STONE. Wood Frog (*Rana sylvatica*), Medford, New Jersey.  
 GEORGE B. WOOD. Head of Sea Turtle, Florida. Snake, West Palm Beach, Florida.  
 DR. H. C. WOOD. Several Reptiles, Jamaica.  
 H. A. VAN VLECK. Eggs of King Snake, Florida.  
 ZOOLOGICAL SOCIETY OF PHILADELPHIA. *Spilotes corais*, intermediate between *couperi* and *melanurus*; Leopard Tortoise, *Clemmys marmoratus*.

#### FISHES.

- C. C. ABBOTT, M.D. Blennoid Fish from Oyster.  
 R. C. ABBOTT. Collection of Fishes from Nantucket, Massachusetts.  
 J. G. DILLIN. *Pomoxis*, Bucks county, Pennsylvania.  
 W. J. EPTING. *Gasterosteus atkinsii*, Jackman, Maine.  
 H. W. FOWLER, C. C. ABBOTT, M.D., and T. D. KEIM. Collection of Fishes, Crosswicks Creek, New Jersey.  
 H. W. FOWLER and DAVID MCCADDEN. Collection of Fishes, Stone Harbor, New Jersey.  
 H. W. FOWLER and T. D. KEIM. Collections of Fishes, Neshaminy Creek,

Pennsylvania, and headwaters of the Allegheny, Genesee and Susquehanna Rivers.

H. W. FOWLER and WITMER STONE. Collection of Fishes, York Furnace, York county, Pennsylvania.

H. W. FOWLER and C. J. HUNT. Collection of Fishes, Pensauken Creek, New Jersey.

H. W. FOWLER. Collections of Fishes from Cape May, New Jersey, Emporium and Bristol, Pennsylvania.

WILLIAM J. FOX. Two barrels of Fish and thirty-one additional specimens from Sea Isle City, New Jersey, including the Eagle Ray (*Myliobates freminvillii*), Thread Herring (*Clupanodon oglinum*), Gar (*Tylosurus raphidoma*), Halfbeak (*Hemiramphus brasiliensis*), Angel Fish (*Pomacanthus arcuatus*), Sail Fish (*Istiophorus nigricans*).

GEORGE Z. HARTMAN. Collection of Fishes, Palermo, New Jersey.

S. P. HEILMAN. Goldfish.

C. A. HIGGINS. Series of Food Fishes from Great Lakes.

P. LORRILLIERE. Brook Trout (*Salmo fontinalis*), Pennsylvania.

H. A. PILSBRY. Perch and several Eels, Delanco, New Jersey.

DR. H. SENIOR. Two Fish, *Hiodon* and *Coregonus*.

DR. H. SKINNER. Jar of Fish, Idaho.

U. S. FISH COMMISSION. Collection of Fishes.

U. S. NATIONAL MUSEUM. *Citharichthys microstomus*, Ocean City, New Jersey.

GEORGE B. WOOD. Skeleton of Puffer; jaws of Shark; bones of Barracuda; collection of Fishes, West Palm Beach, Florida.

#### INSECTS.

WILLIAM BEUTENMULLER. Two hundred Coleoptera, North Carolina.

C. R. BIEDERMAN. Eight Coleoptera, Arizona.

P. BIELLEY. Eighty-nine Orthoptera, Costa Rica.

BROOKLYN INSTITUTE. Eighteen Orthoptera, South America and Tonkin.

A. E. BROWN. Three Mallophaga, Philadelphia.

L. BRUNER. One Orthoptera, British Guiana.

P. P. CALVERT. Six insects, New York, and four hundred and sixty insects from Mexico.

D. M. CASTLE. Twelve Coleoptera, United States.

T. D. A. COCKERELL. Two Hymenoptera, Colorado.

E. T. CRESSON. One Hymenoptera, United States.

J. C. CRAWFORD. Twenty-five Hymenoptera, Costa Rica, and one, Nebraska.

E. DAECKE. Ten Diptera, New Jersey.

H. W. FOWLER. Twenty-seven insects, Pennsylvania.

W. J. FOX. Twelve Coleoptera, New Jersey.

JOSEPH GRINNELL. Thirty Orthoptera, California.

F. HAINBACH. Four Lepidoptera, New Jersey.

H. D. HOCHENBERRY. Specimen of wood bored by Bees.

CARL ILG. Thirty Lepidoptera, Philadelphia.

G. M. GREENE. Three hundred and five insects from Pennsylvania.

M. HEBARD. Twenty-five Orthoptera, Jerusalem.

BAYARD LONG. Seventy-five Orthoptera, Pennsylvania and New Jersey.

D. N. McCADDEN. Four Diptera, New Jersey.

R. E. NICHOLSON. One Lepidoptera, Pennsylvania.

H. A. PILSBRY. One hundred and seventy-five insects, Arizona.

DR. C. W. RICHMOND. Two Spiders, Pennsylvania.

HENRY SKINNER. Fifty-nine Lepidoptera, United States.; forty-five Lepidoptera, California; fifty Odonata, Idaho; seventy Lepidoptera, Colima, Mexico; twenty-seven Diptera, Idaho; five Lepidoptera, Japan; two Odonata, Yellowstone Park; fourteen Odonata, Pennsylvania; thirty-three Lepidoptera, Idaho.

WITMER STONE. One hundred and thirty-nine insects, Minnesota.

H. L. VIERECK. Fifty-nine Diptera, New Jersey; fifty-three Hymenoptera, Pennsylvania; twenty-five insects, United States.

H. W. WENZEL. Eighteen Coleoptera, Europe.

H. E. WETHERELL. Thirty-three insects, Panama.

H. F. WICKHAM. Eight Coleoptera, United States.

JOSEPH WILLCOX. Scorpion, Florida.

#### MOLLUSCA.

MRS. HELEN G. ABBOTT. *Pyramidula alternata* Say and *Lymnaea megasoma* Say from Lake Minnetonka, Minnesota.

JACOB AEBLY. *Viviparus malleatus* Rve., five and one-half years old, raised in an aquarium.

A. and J. BAILY. Eight trays of American land and marine shells.

C. F. BAKER. Ten trays of Cuban marine shells.

F. C. BAKER. Nine species of American fresh-water shells.

W. T. BEDNALL. Four Chitons from Port Elliott, South Australia.

BERNICE PAUHI BISHOP MUSEUM. Fifteen species of Hawaiian Island land shells in exchange.

C. R. BIEDERMAN. *Psidium* from Reef, Arizona.

FORTUNATO BONIS. Fifteen species of land shells from Cauca, Colombia.

J. CHESTER BRADLEY. Three trays of fresh-water shells from the Selkirk Mountains, British Columbia.

STEWARTSON BROWN. Thirty-three species of land and marine shells from Bermuda, and twenty trays of land and fresh-water shells from British Columbia.

GEORGE H. CLAPP. Four species of land and fresh-water shells from North America.

T. D. A. COCKERELL. Twelve trays of land and fresh-water shells from New Mexico.

H. S. COLTON. *Strombus pugilis* L. from Clearwater Harbor, Florida.

CHARLES H. CONNER. Two Unios from the Delaware River.

L. E. DANIELS. *Segmentina crassilabris* Wkr. from White and Knox counties, Indiana.

DR. S. G. DIXON. Three species of fresh-water shells from Puzzle Lake, Ontario.

J. H. FERRISS. Six species of Western land shells.

H. W. FOWLER. Fifteen trays of shells from Potter and McKean counties, Pennsylvania.

WILLIAM J. FOX. *Loligo* from Sea Isle City, New Jersey.

L. S. FRIERSON. Three species of land shells from near Frierson, Louisiana.



- B. W. GREENWOOD. One pearl from *Ostrea virginica* Gmel.  
A. GULICK. *Eulota blakeana* from Sapporo, Japan.  
DR. HARSHBERGER. Five land shells from Harrington Sound, Bermuda.  
MORGAN HEBARD. Eight species of *Achatinella*.  
C. HEDLEY. *Tellina fabrefacta* Pils. from Masthead Island, Queensland.  
ANGELO HEILPRIN. *Cerion ura* L. and *Tudora megacheila* P. M., Curacao.  
J. B. HENDERSON, JR. *Opeas gracile* Hutt from Port au Prince, Haiti, and *Zonitoides arborea* Say from Cazenovia, New York.  
JUNIUS HENDERSON. Eight trays of land and fresh-water shells from Colorado.  
DR. H. M. HILLER. Nine species of Cuban land shells.  
A. A. HINKLEY. Four fresh-water shells from Alabama.  
Y. HIRASE. A *Situla* from China.  
MRS. AGNES F. KENYON. Twenty-nine species of marine shells from Victoria, Australia.  
N. W. LERMOND. Twenty trays of land shells from Maine.  
H. H. LEWIS. An *Octopus* from Bahama Islands.  
MISS E. L. LUNDY. Fourteen trays of marine and fresh-water shells.  
DR. F. M. MACFARLAND. *Physa* from Grand Canyon, Arizona.  
J. G. MALONE. Sixteen trays of land and fresh-water shells from Washington and Oregon.  
R. V. MANN. *Oreoheliz depressa* Ckll. from near Boulder, Colorado.  
W. E. MEEHAN. *Margaritana margaritifera* L. from Still Creek, Schuylkill county, Pennsylvania.  
MILWAUKEE PUBLIC MUSEUM. Seventy trays of fresh-water shells.  
CLARENCE B. MOORE. Seventy-three trays of land and fresh-water shells from Georgia, Alabama and Florida.  
DR. WILLIAM A. NASON. Three species of land shells.  
F. PENNELL. Two land shells from Wawa, Pennsylvania.  
H. A. PILSBRY. Three hundred and nineteen trays of land and fresh-water shells.  
PURCHASED. The J. Gulick Collection of Hawaiian land shells, containing five hundred and sixty-five trays. Three hundred and thirty-one trays of Alabama fresh-water shells, collected by H. H. Smith.  
J. A. G. REHN. Six trays of fresh-water shells from Cornwells, Bucks county, Pennsylvania.  
S. N. RHOADS. Sixty-four trays of land and fresh-water shells from Eastern United States.  
J. RITCHIE, JR. Twenty-one trays of land and marine shells.  
MRS. SCHAEFFER and Miss JAMES. Six species of land and fresh-water shells from British Columbia.  
DR. B. SHARP. Two trays of *Ostrea virginica*.  
DR. H. SKINNER. Seven trays of land and fresh-water shells from Idaho, Montana and Indiana.  
DR. V. STERKI. Two land shells from Ohio.  
WITMER STONE and H. W. FOWLER. Twelve trays of land and fresh-water shells from Pennsylvania and Minnesota.  
D. THAANUM. Seven Hawaiian land shells.  
W. G. TORR. Seven Chitons from South Australia.  
DR. R. H. TREMPER. *Epiphragmophora tudiculata* Binn. from Ontario, California.

- E. G. VANATTA. Fifteen trays of land shells from the Eastern United States.  
T. VAN HYNING. Three trays of land and fresh-water shells from Iowa.  
H. L. VIERECK. Five species of land and marine shells from Connecticut and New Jersey.  
BRYANT WALKER. Thirteen species of land and fresh-water shells from Michigan, Minnesota and Indiana.  
WALTER F. WEBB. Twelve species of East Indian land and fresh-water shells.  
REV. W. H. WEBSTER. Ten species of *Monodonta* and *Calliostoma* from New Zealand.  
EDWARD E. WILDMAN. *Purpura lapillus* L. from Greenings Island, Maine, and Woods Hole, Massachusetts.  
J. WILLCOX. Two species of fresh-water and marine shells from Sarasota Bay, Florida.  
H. T. WOLF. *Lymnæa stagnalis* L. from an aquarium.

## WORMS.

- DR. H. C. CHAPMAN. Three bottles of *Polychæta*, two *Myzostoma* and a Nematode.  
H. B. DAVIS. *Tænia serrata*.  
H. W. FOWLER. *Erpobdella punctata*, *Gordius*, *Placobdella*.  
W. J. FOX. *Ascaris* from Codfish.  
C. B. MOORE. *Fridericia*, Florida.  
J. P. MOORE. *Planaria gonocephala* and *Glossiphonia*, *Dasychone* and *Pomatostegus*; three hundred and thirty-eight bottles of *Polychæta*.  
DR. C. B. PENROSE. *Ptychobothrium* and *Filaria immitis*.  
PROF. C. E. PORTER. *Glossiphonia* and *Geoplana*.  
MRS. CHARLES SCHAEFFER. *Planaria*, British Columbia.  
MISSES STEVENS and BORING. Four bottles of *Planaria morgani*, including the type.  
PROF. A. L. TREADWELL. Twelve species of *Polychæta*.  
E. G. VANATTA. *Allolobophora longa*, Maryland.  
W. M. WHEELER. Nine species of *Myzostomata*, including several cotypes.

## CRUSTACEA, ECHINODERMATA, ETC.

- DR. H. C. CHAPMAN. Sixty-two jars of invertebrates from Naples, Italy.  
WILLIAM J. FOX. A Starfish from Sea Isle City, New Jersey.  
MRS. AGNES F. KENYON. One jar of Crustacea from Victoria, Australia.  
MISS E. L. LUNDY. Two corals.  
S. EDWARD PASCHALL. One jar of Hermit Crabs from the south coast of Haiti.  
H. L. VIERECK. A Starfish from Double Beach, Connecticut.  
J. WILLCOX. A jar of Scorpions from Sarasota Bay, Florida.  
HELEN WINCHESTER. *Lepas* from Ocean Grove, New Jersey.  
WOODS HOLE BIOLOGICAL STATION. Ten Barnacles from Woods Hole, Massachusetts.

## ARCHÆOLOGY.

- DR. CYRUS A. PETERSON. Model of Moreles Mound, Illinois.  
E. P. COWELL. Cast of head of Negro.

CLARENCE B. MOORE. Numerous additions to the C. B. Moore Collection of Indian pottery, etc., from the mounds of Southern Atlantic and Gulf States.

#### INVERTEBRATE FOSSILS.

CLARENCE B. MOORE. Two trays of fossil invertebrates from Georgia and Florida.

C. AULOMETTE SHEPARD. *Latirus floridanus* Heilpr. from Tampa, Florida.

JOSEPH WILLCOX. Seventy species of fossils from the Eastern United States.

MRS. W. S. BOWEN. Several fossil invertebrates.

#### MINERALS, ETC.

MISS E. L. LUNDY. Miscellaneous collection of rocks, etc.

J. L. NORTH. Mill cinder (supposed meteorite), Sewell, New Jersey.

E. A. PITMAN. Collection of minerals and rocks.

HENRY A. SCHWEYER. Serpentine slab, Easton, Pennsylvania.

DR. BENJAMIN SHARP. Iron ore, Michigan.

WILLIAM S. VAUX COLLECTION. Numerous specimens purchased.

#### PLANTS.

STEWARDSON BROWN. Collection of Florida plants.

JOSEPH CRAWFORD. One hundred and fifty plants from various localities.

JOSEPH CRAWFORD, BAYARD LONG and S. S. VAN PELT. One hundred and twenty plants from the Adirondack Mountains, New York.

DR. JOHN W. HARSHBERGER. Fifty-five plants from Vermont.

DR. IDA A. KELLER. One hundred plants, Glen Onoko, Pennsylvania, and Cape Vincent, New York.

BAYARD LONG. Fifty plants, Pocono region of Pennsylvania.

NEW YORK BOTANICAL GARDENS. General collection of about 1,100 specimens, in exchange; principally from Southern California, Central America and the West Indies.

PHILADELPHIA BOTANICAL CLUB, THROUGH VARIOUS OF ITS MEMBERS. Two thousand plants.

BENJAMIN H. SMITH. Small collection of plants from various localities.

WITMER STONE. Eighty-five specimens of plants from Minnesota.

UNITED STATES NATIONAL MUSEUM, IN EXCHANGE. Specimens of *Viola painteri*, *Townsendia wilcoxiana* and *Phillopterus macrorhizus*.

CHARLES S. WILLIAMSON. Fifty plants from various localities.

FRANCIS WINDLE. Specimen of *Panicum philadelphicum*.

ACADEMY EXPEDITIONS. Canadian Rocky Mountains, Stewardson Brown collector, four thousand specimens. Arizona, Dr. H. A. Pilsbry collector, two hundred and fifty specimens.

BOTANICAL SECTION—PLANTS PURCHASED. J. W. Blankenship, Montana, 583; A. A. Heller, Western America, 1,403; A. O. Garrett, Utah, 100; Charles H. Shaw, Selkirk flora, 545.

# INDEX TO SPECIES, ETC., DESCRIBED AND REFERRED TO IN THE PROCEEDINGS FOR 1906.

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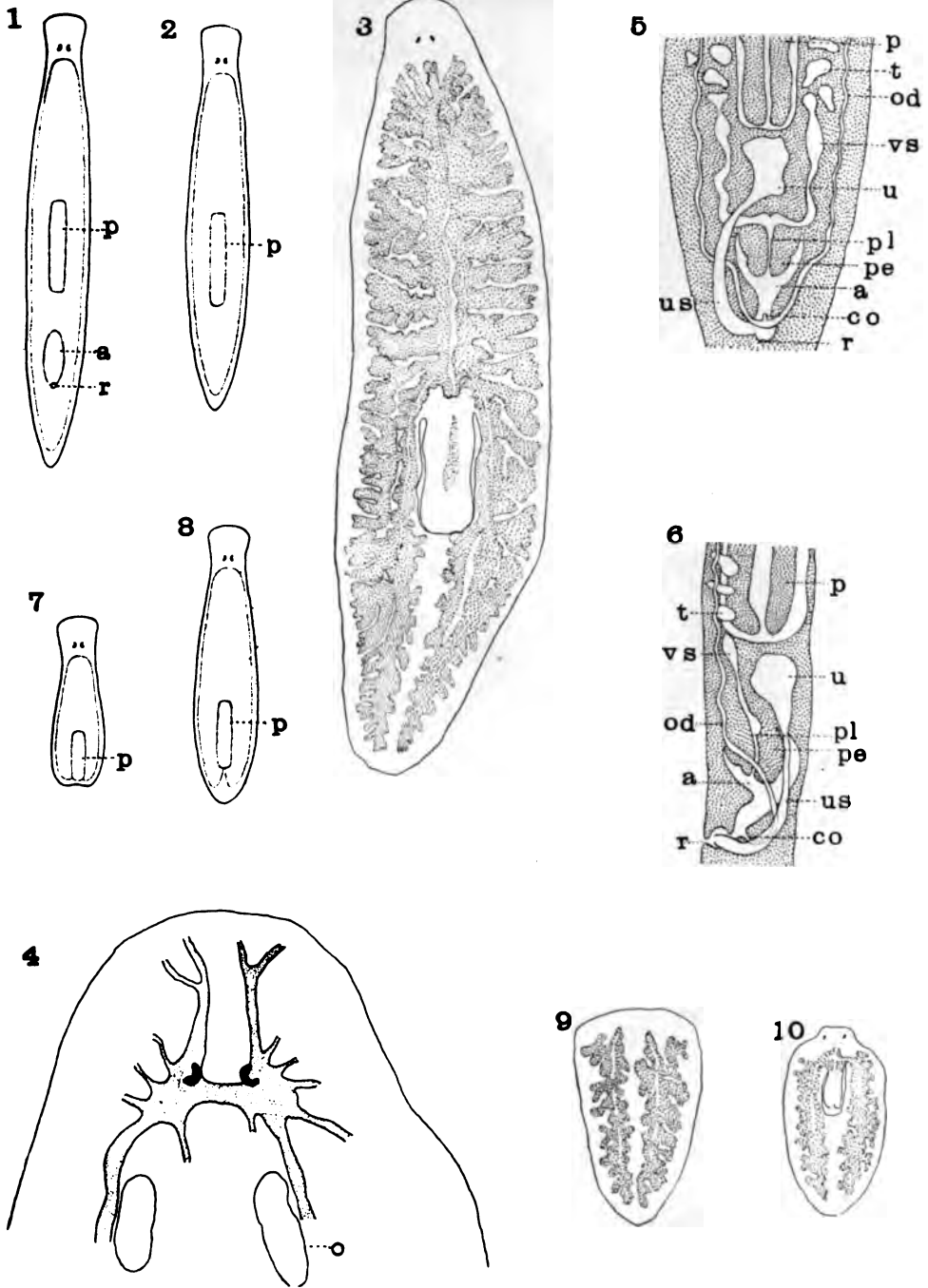
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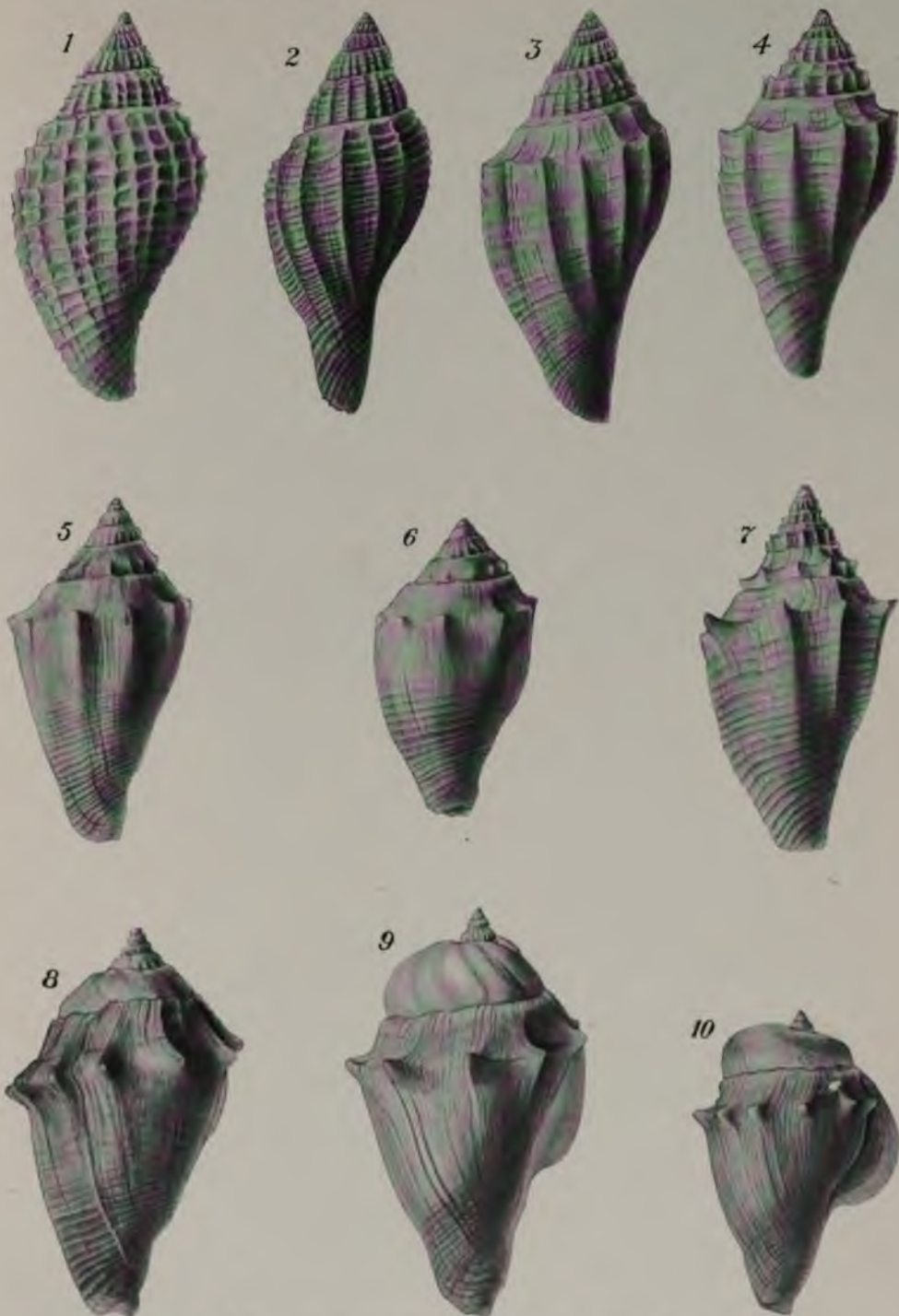
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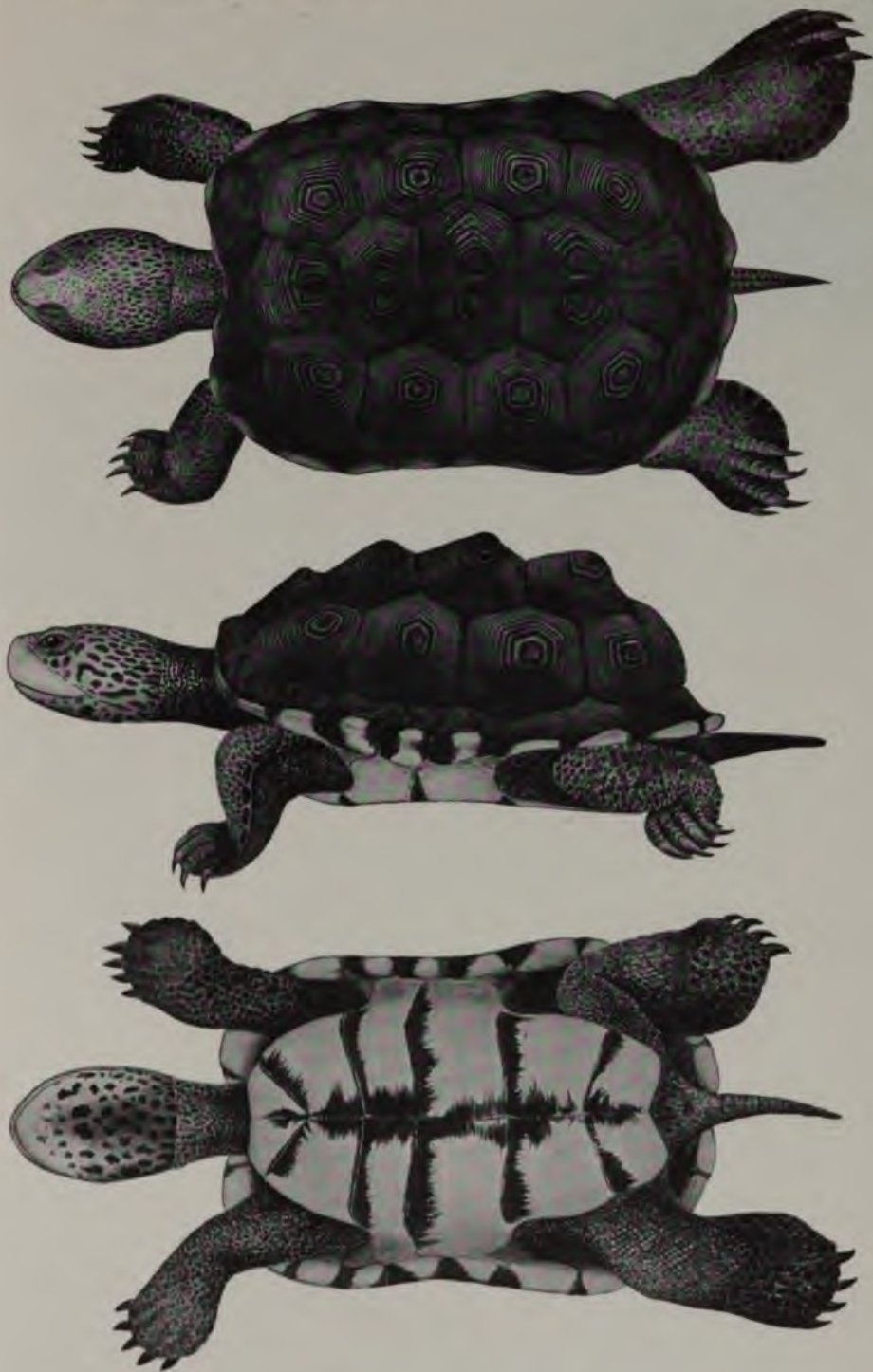






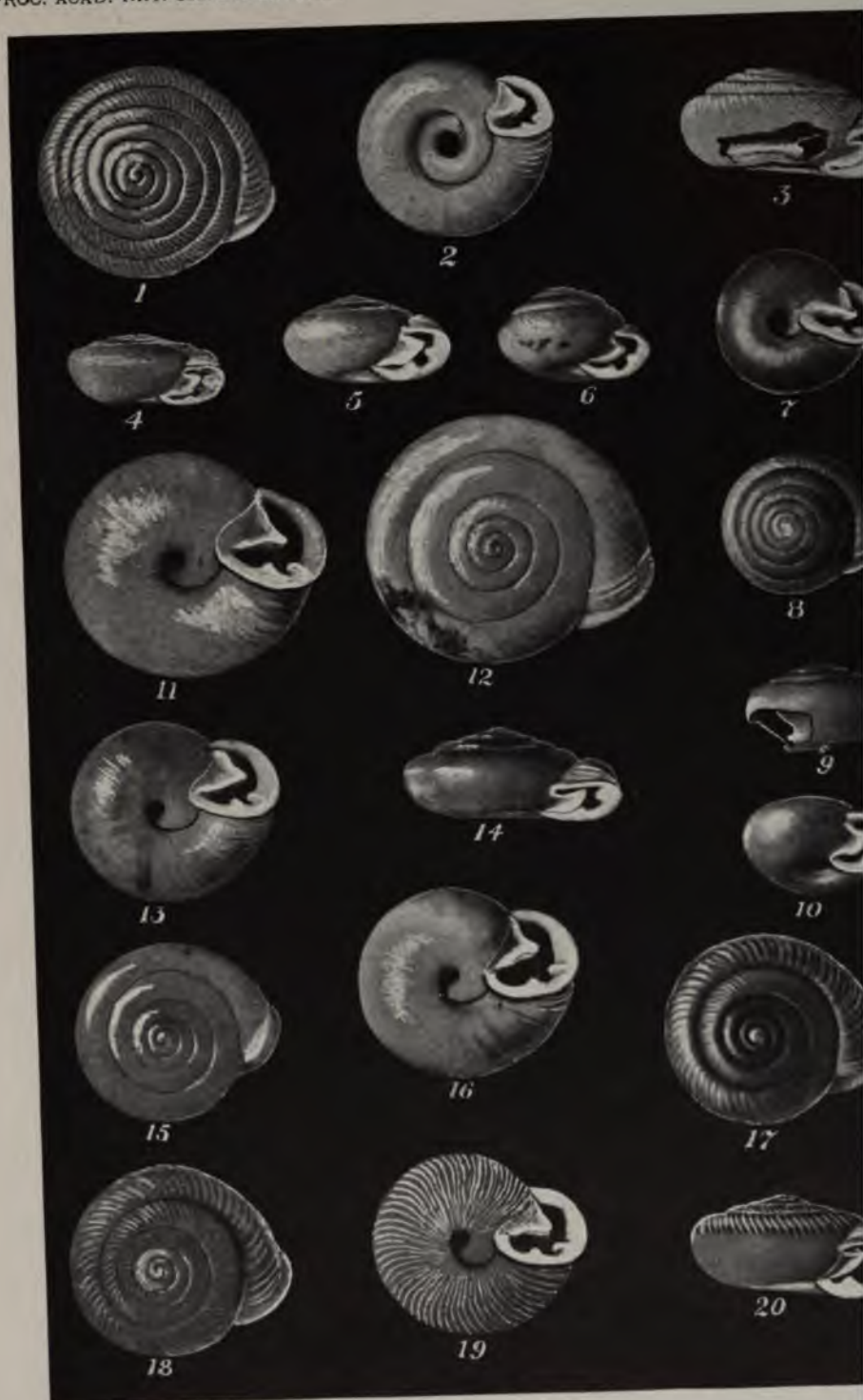
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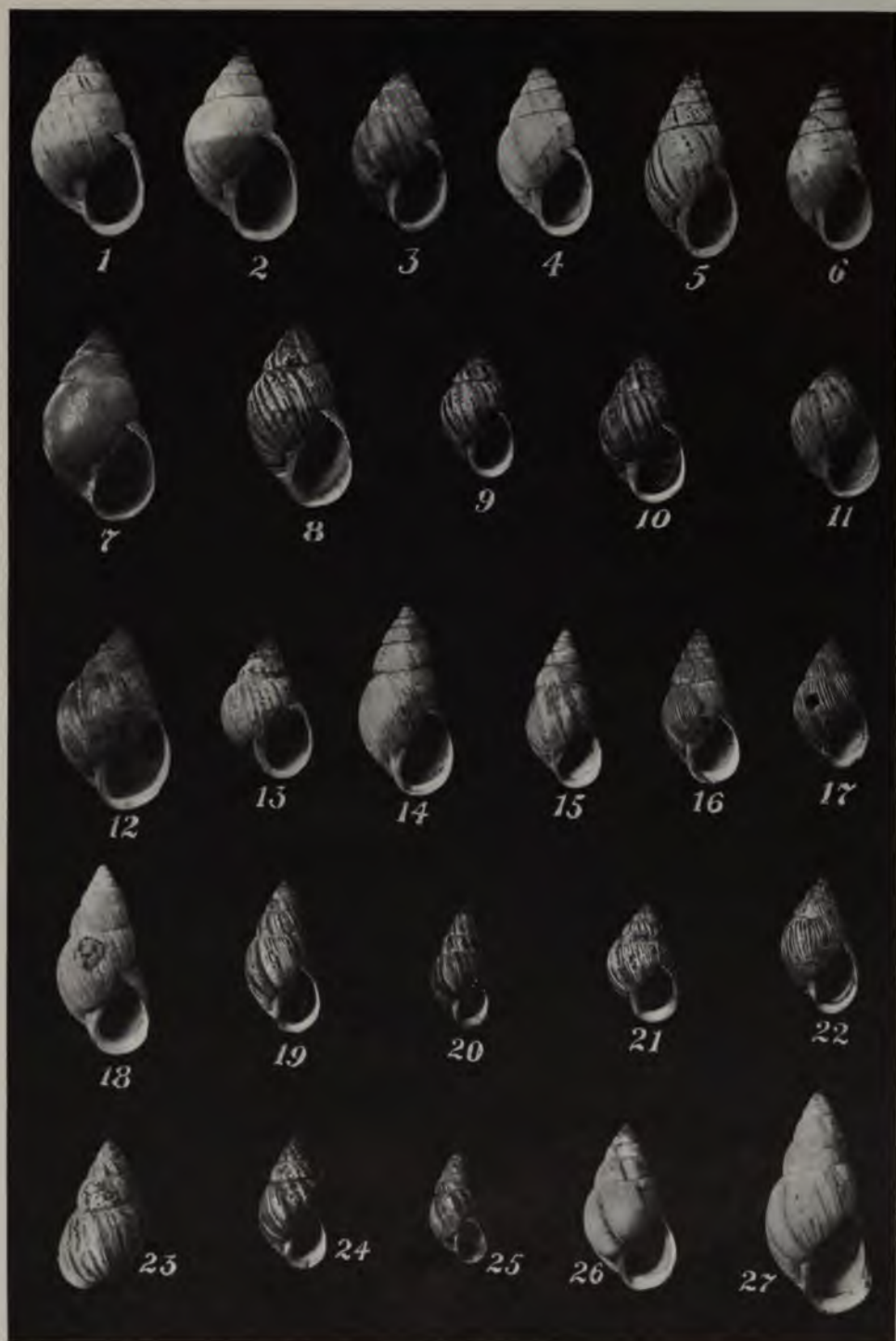




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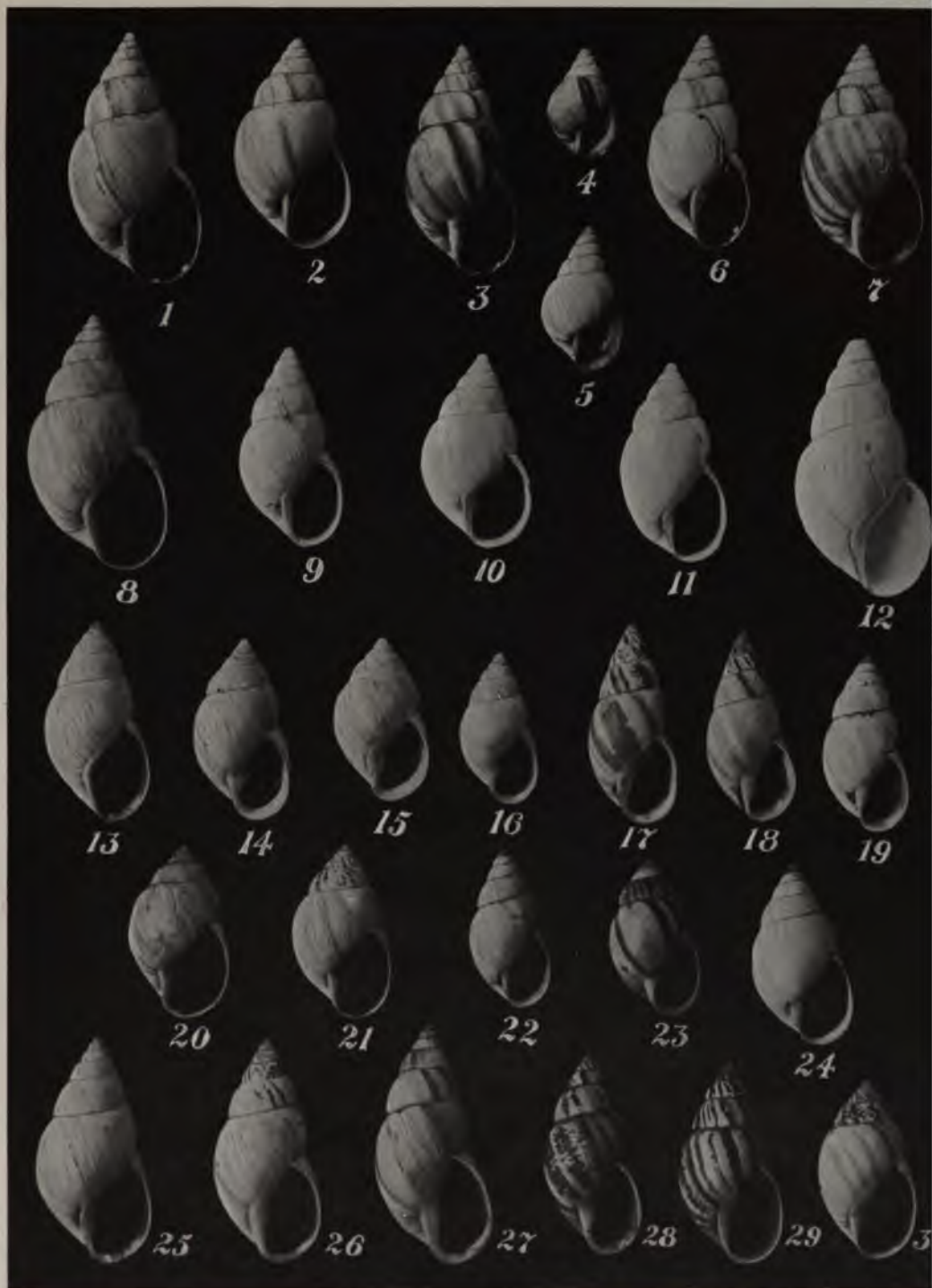




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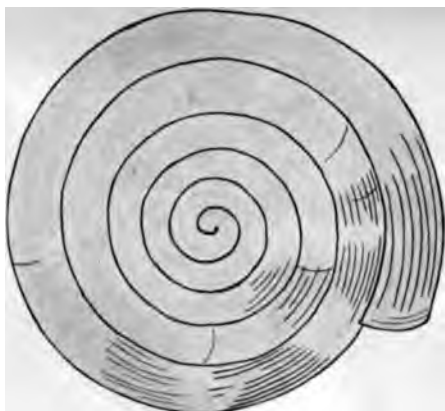






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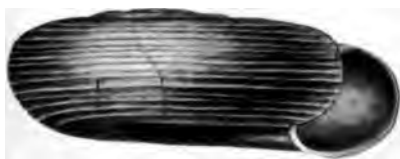
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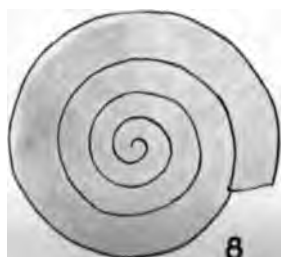
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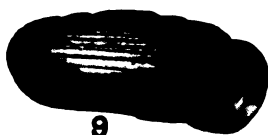
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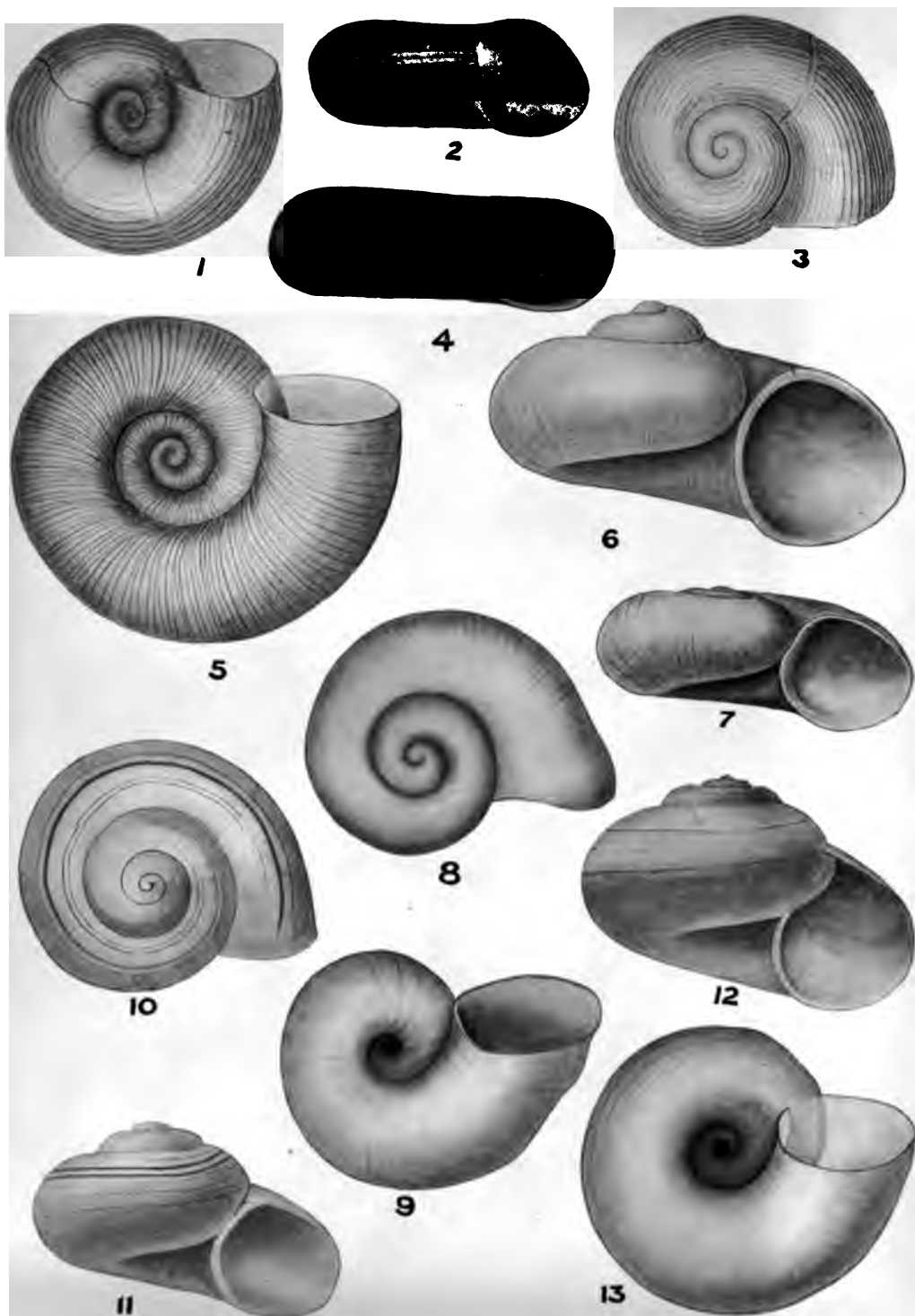


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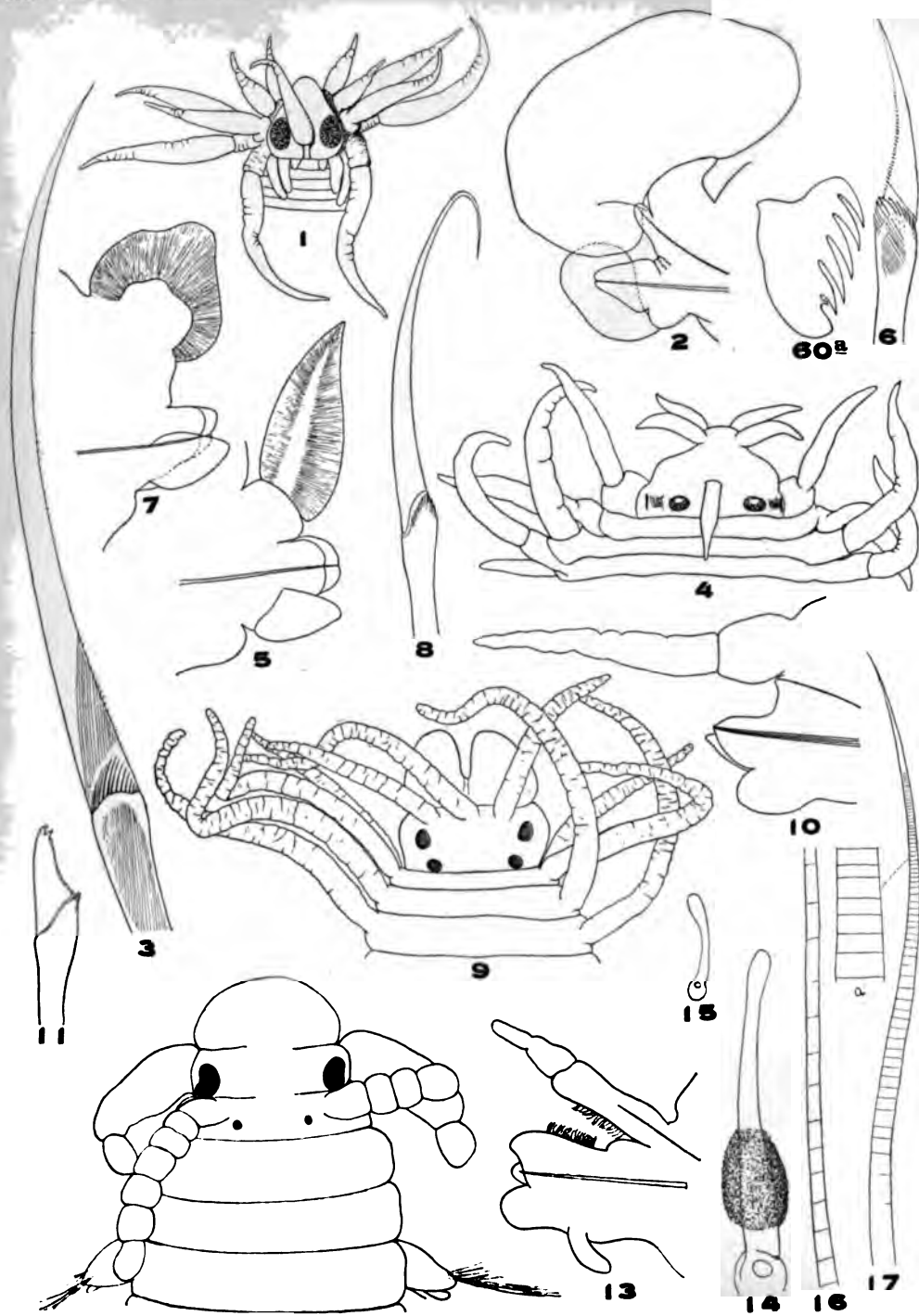
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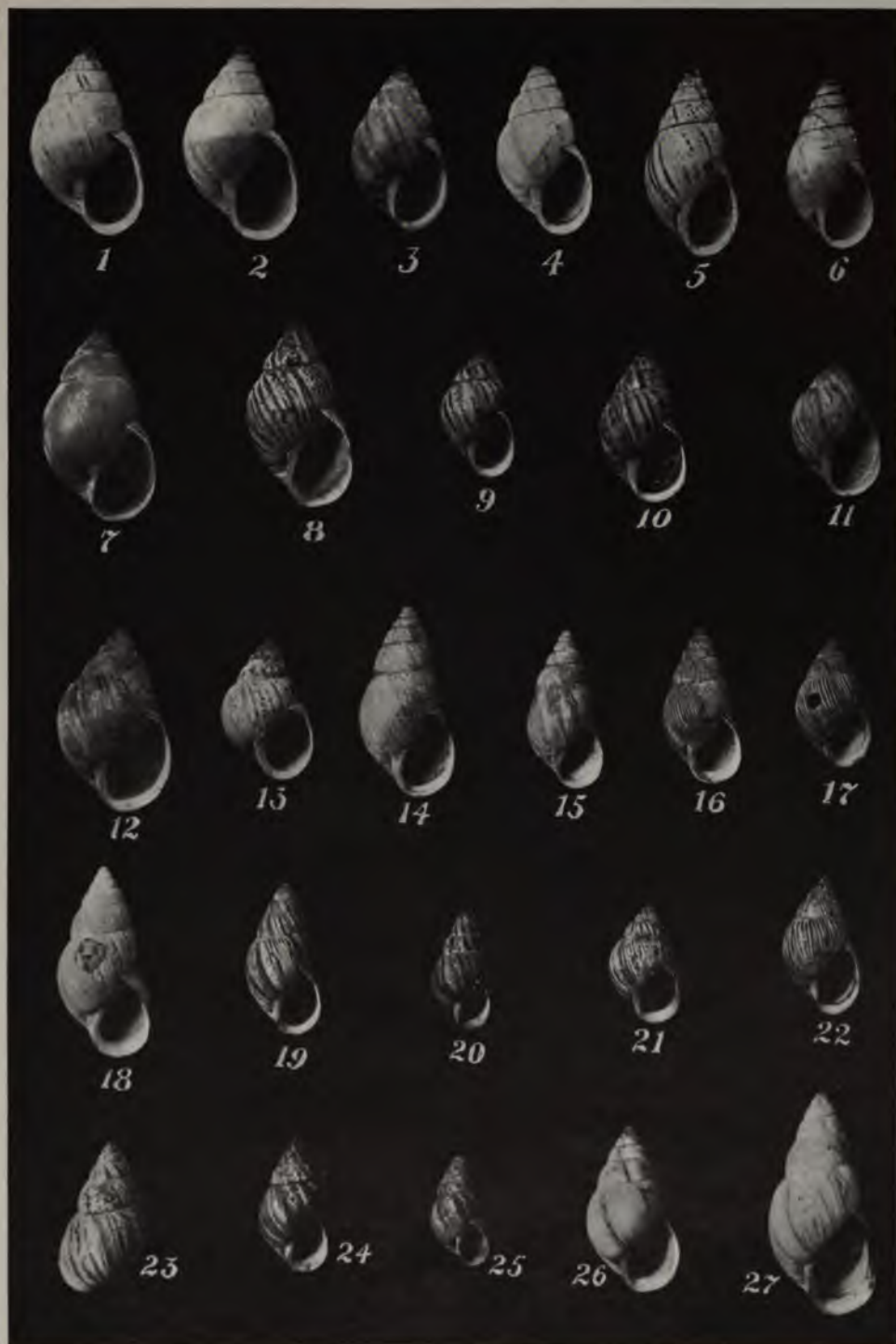
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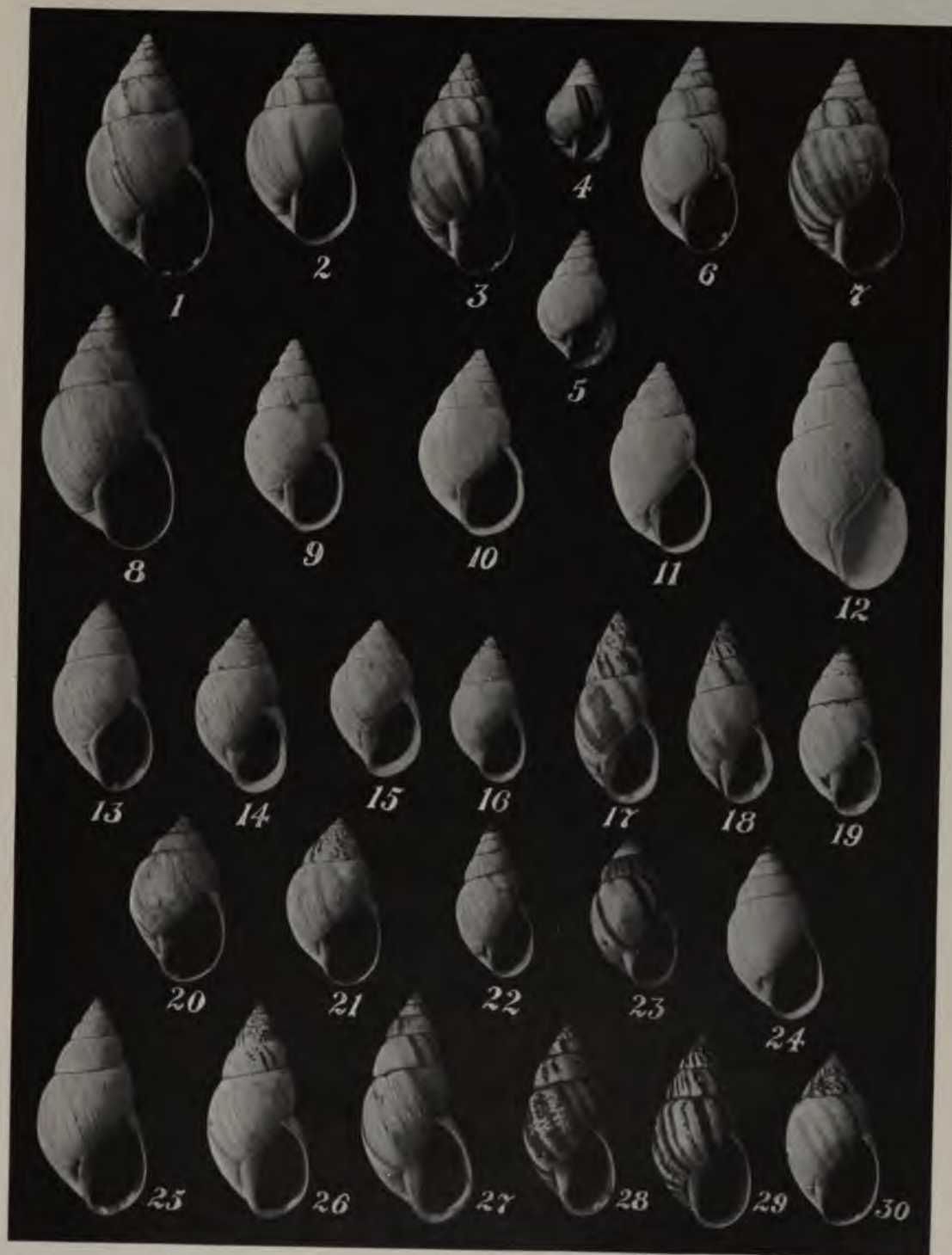






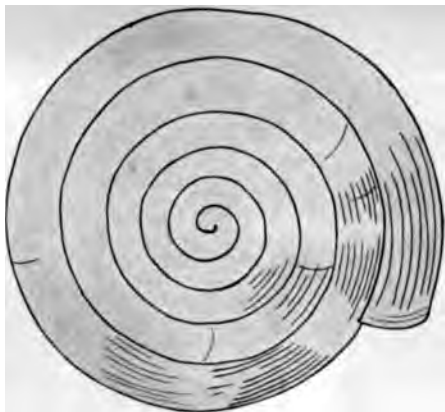
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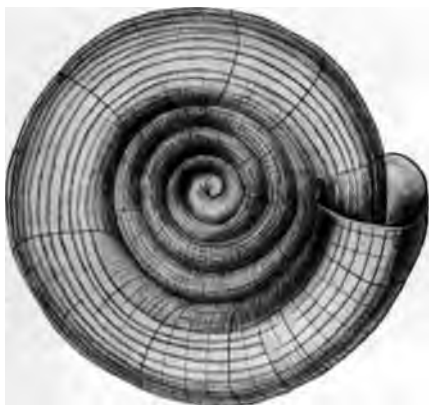




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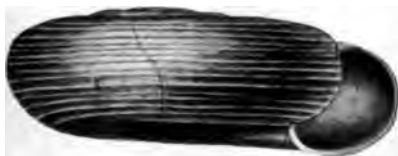
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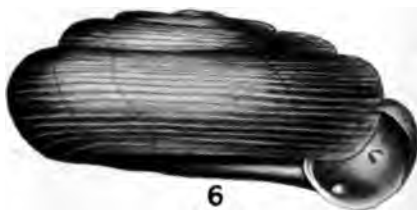
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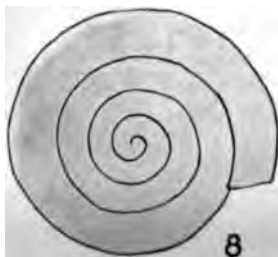
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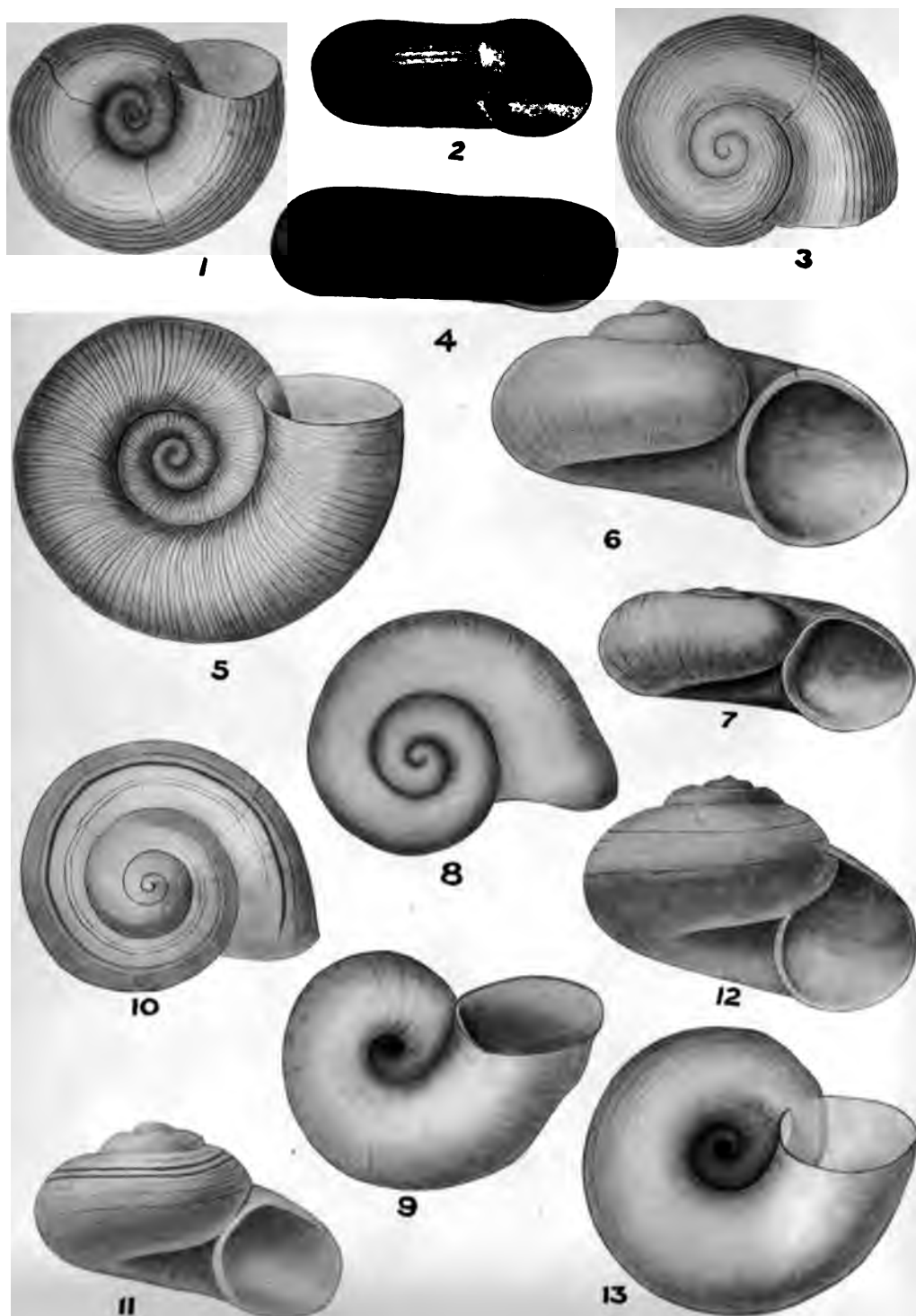


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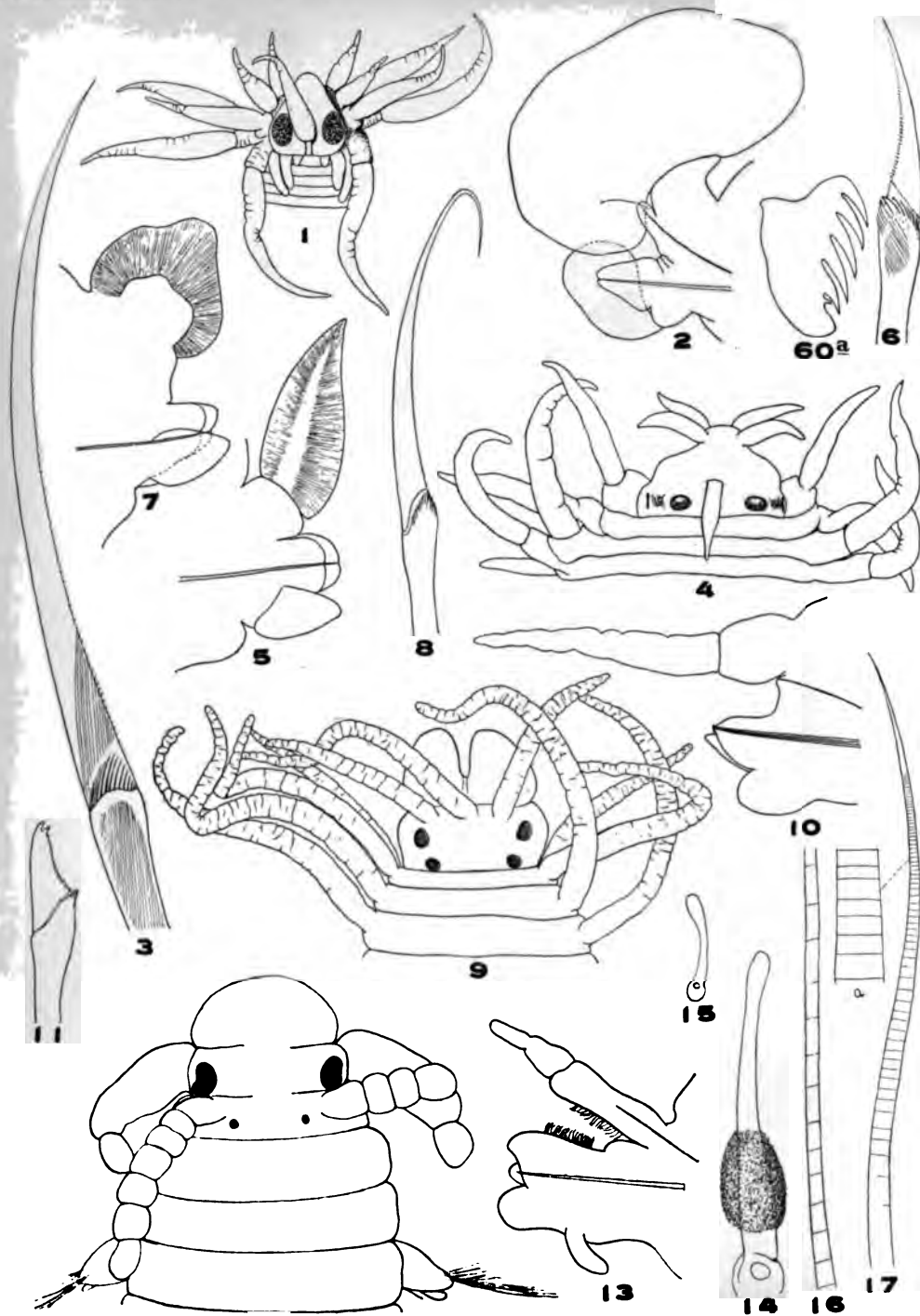
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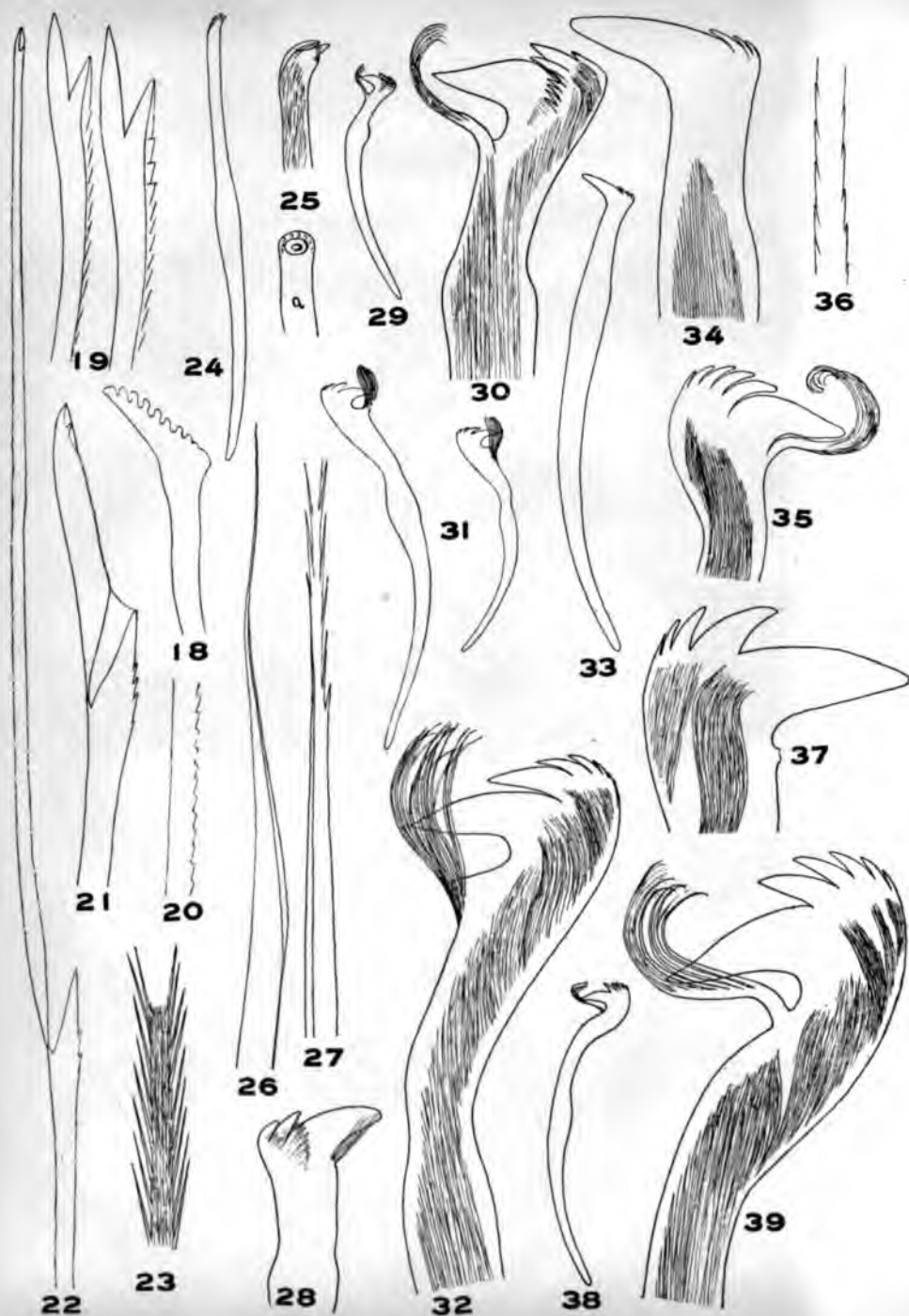






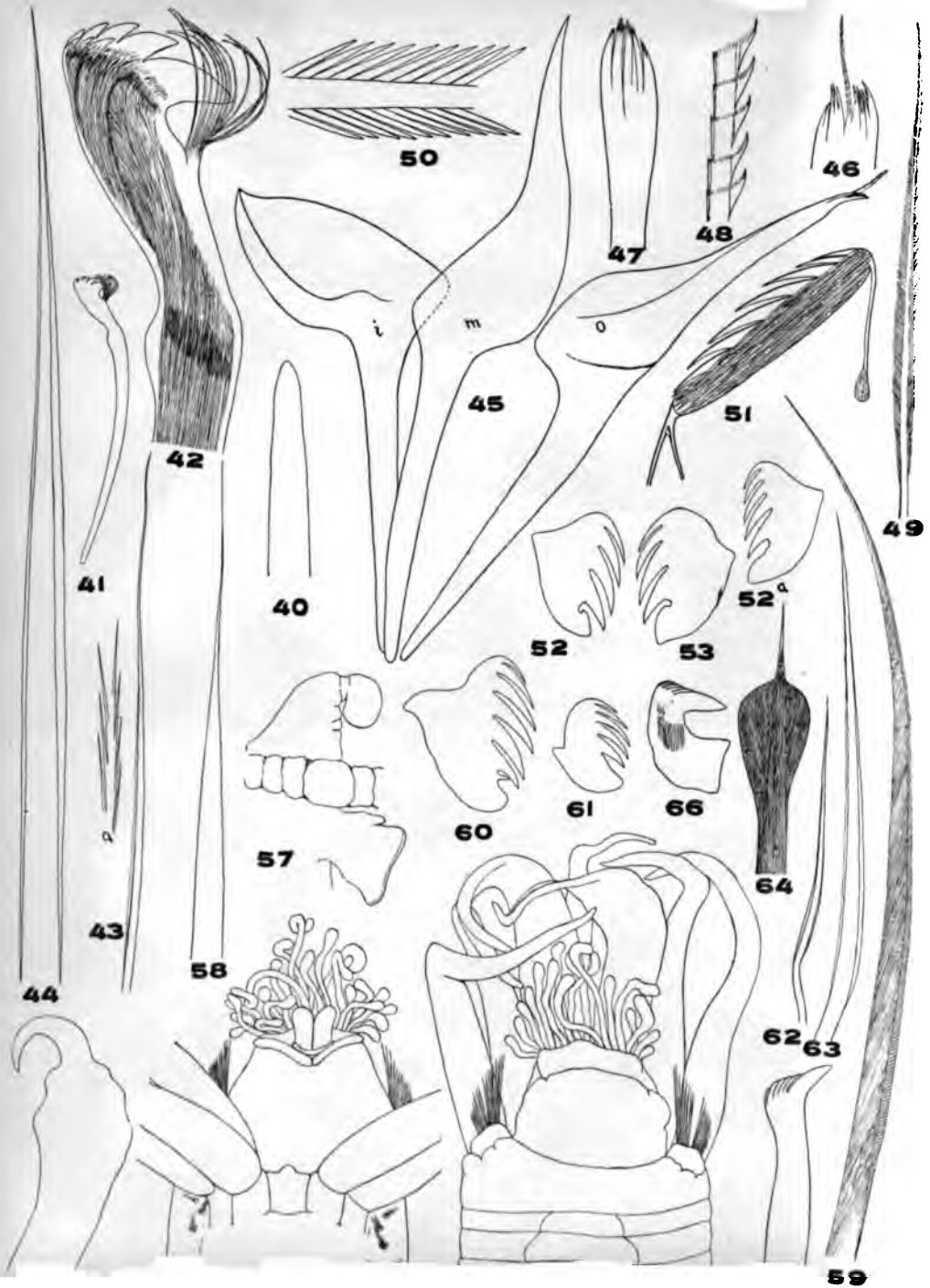




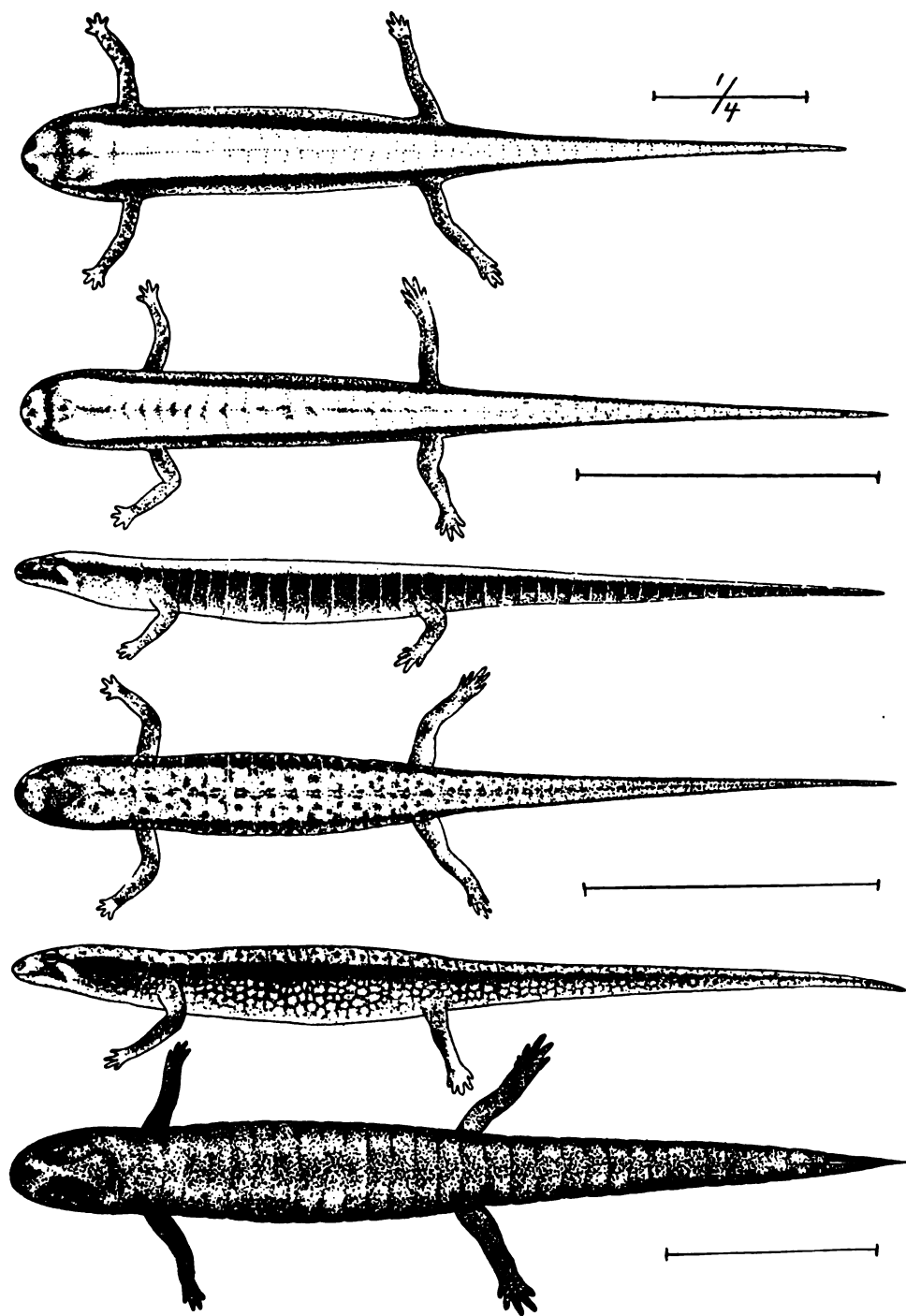


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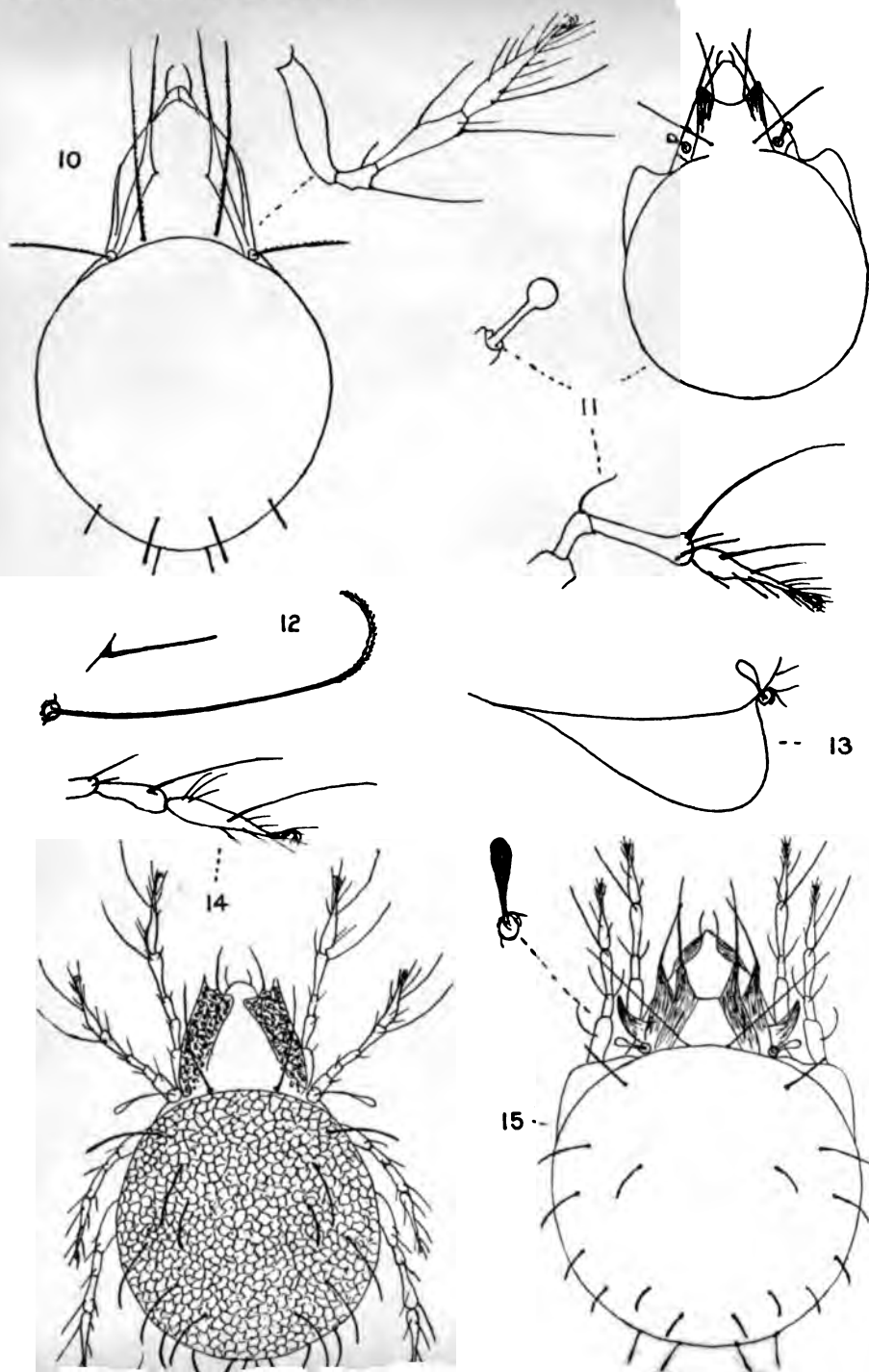
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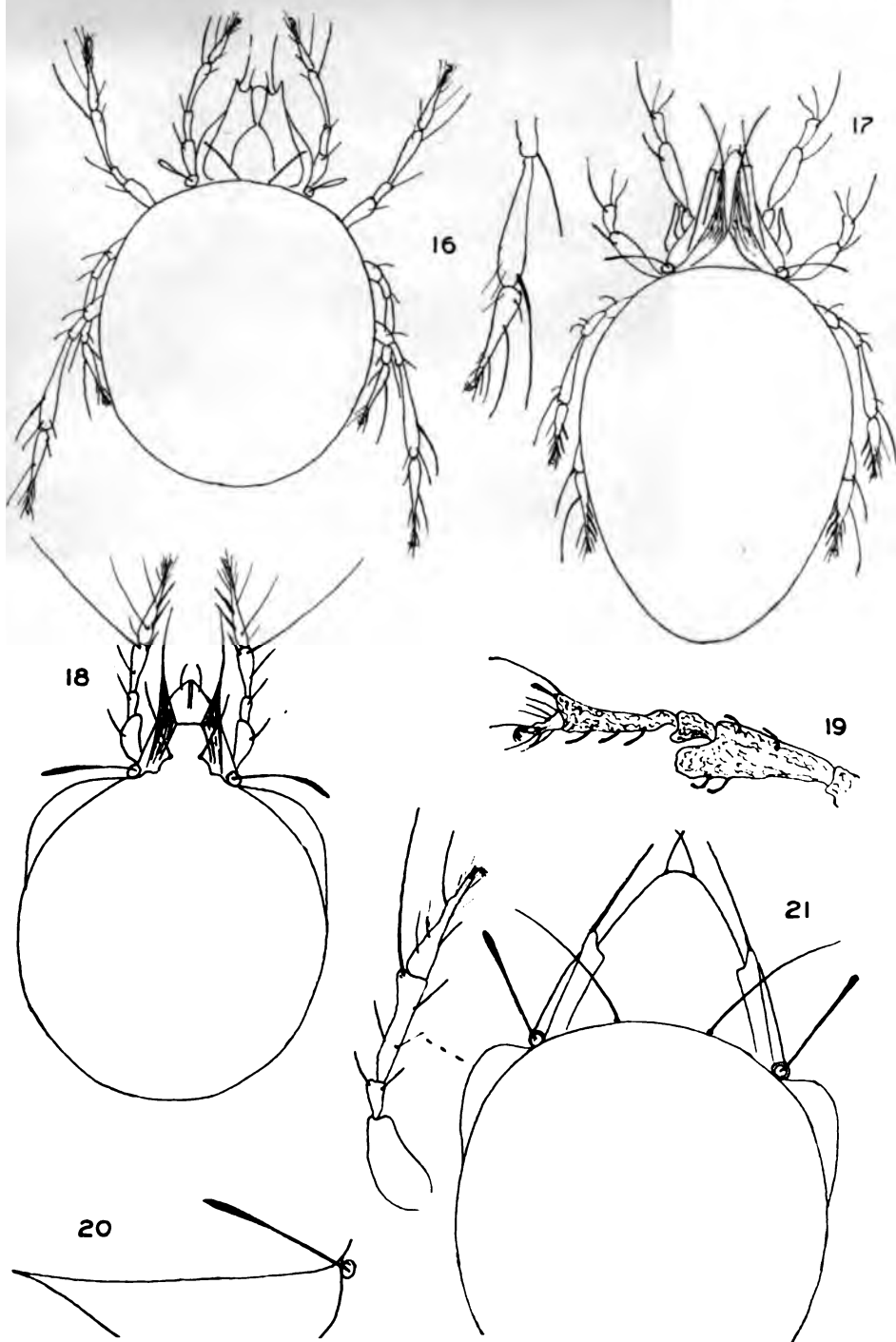




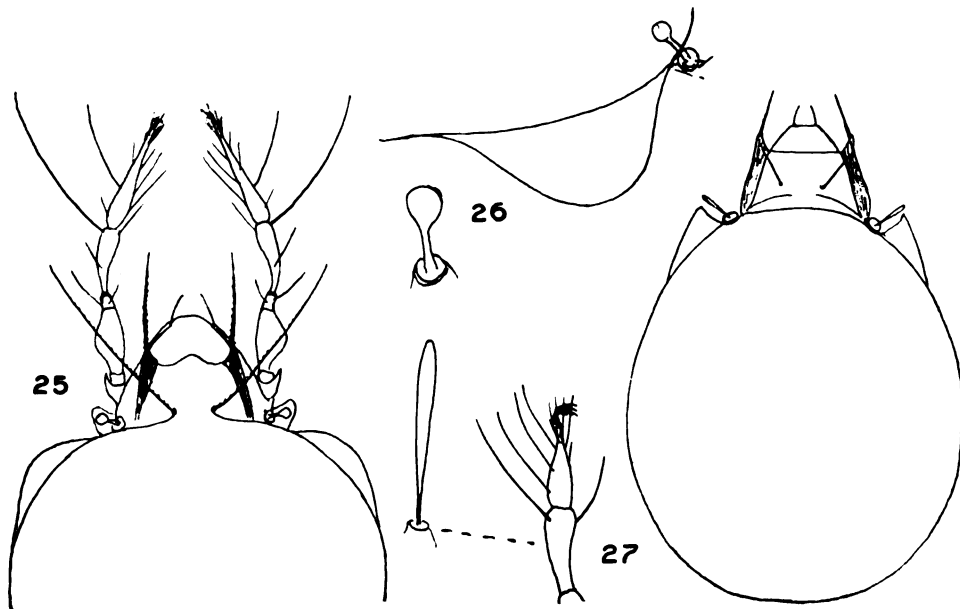
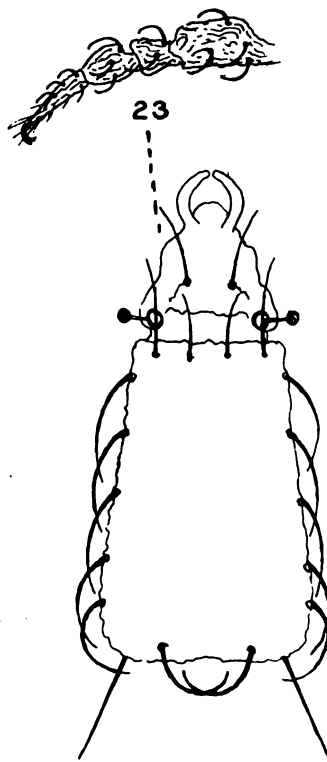
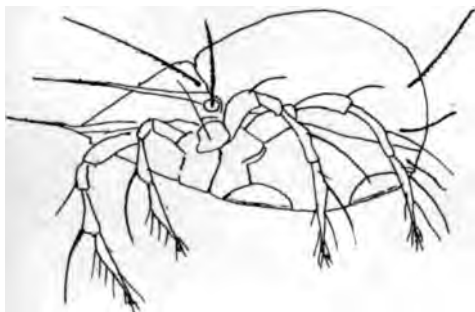






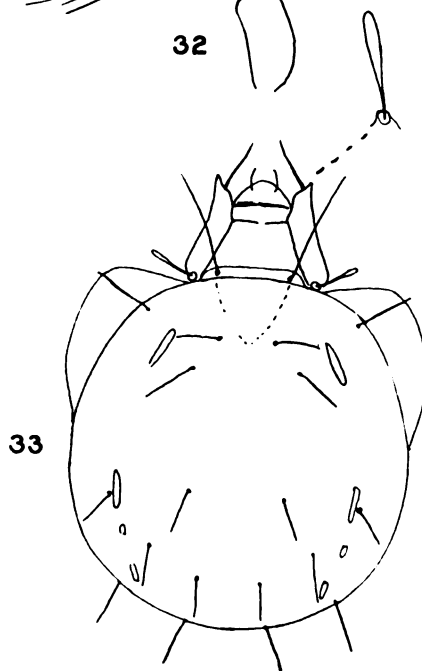
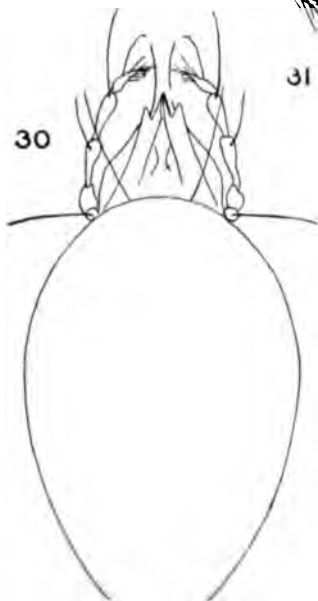
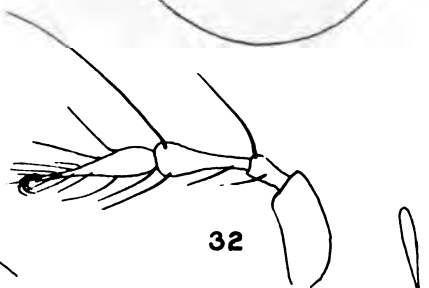
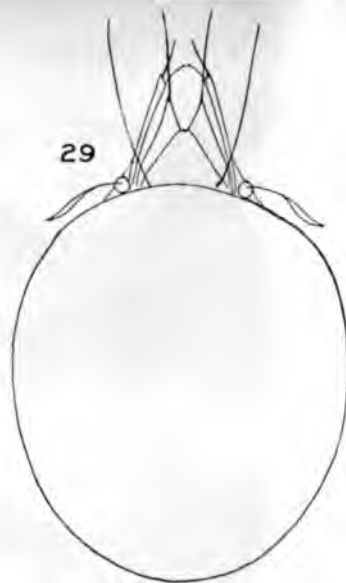
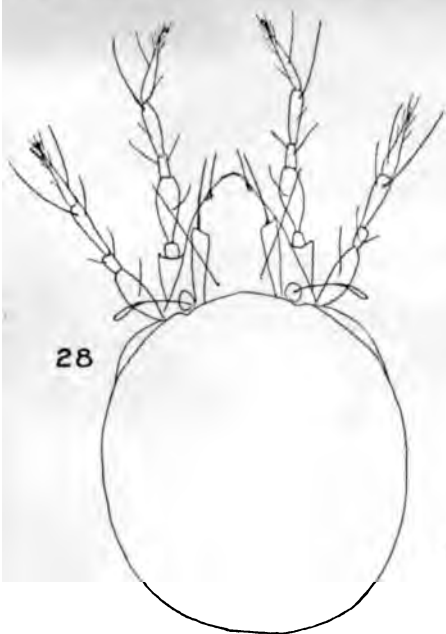




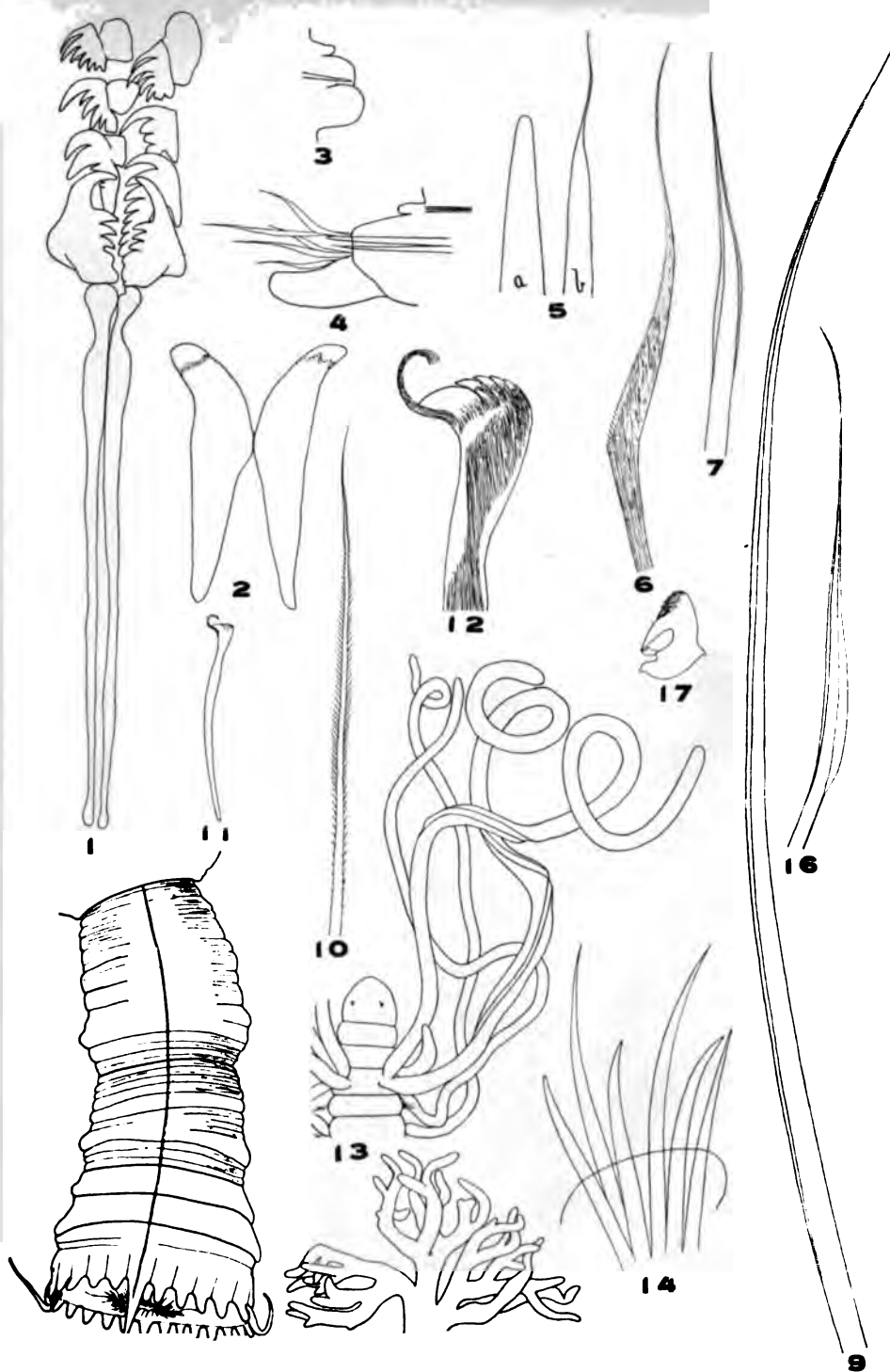




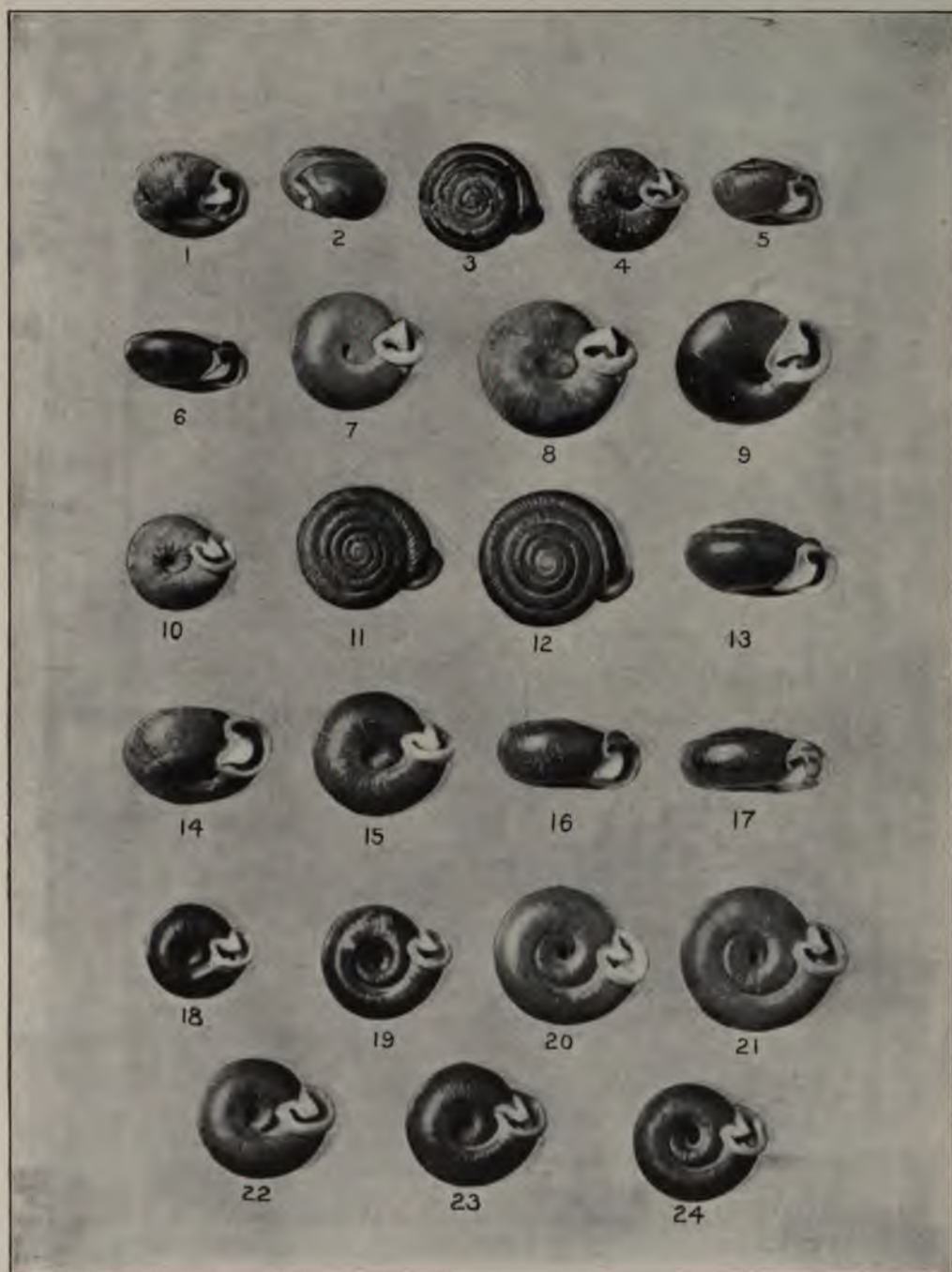




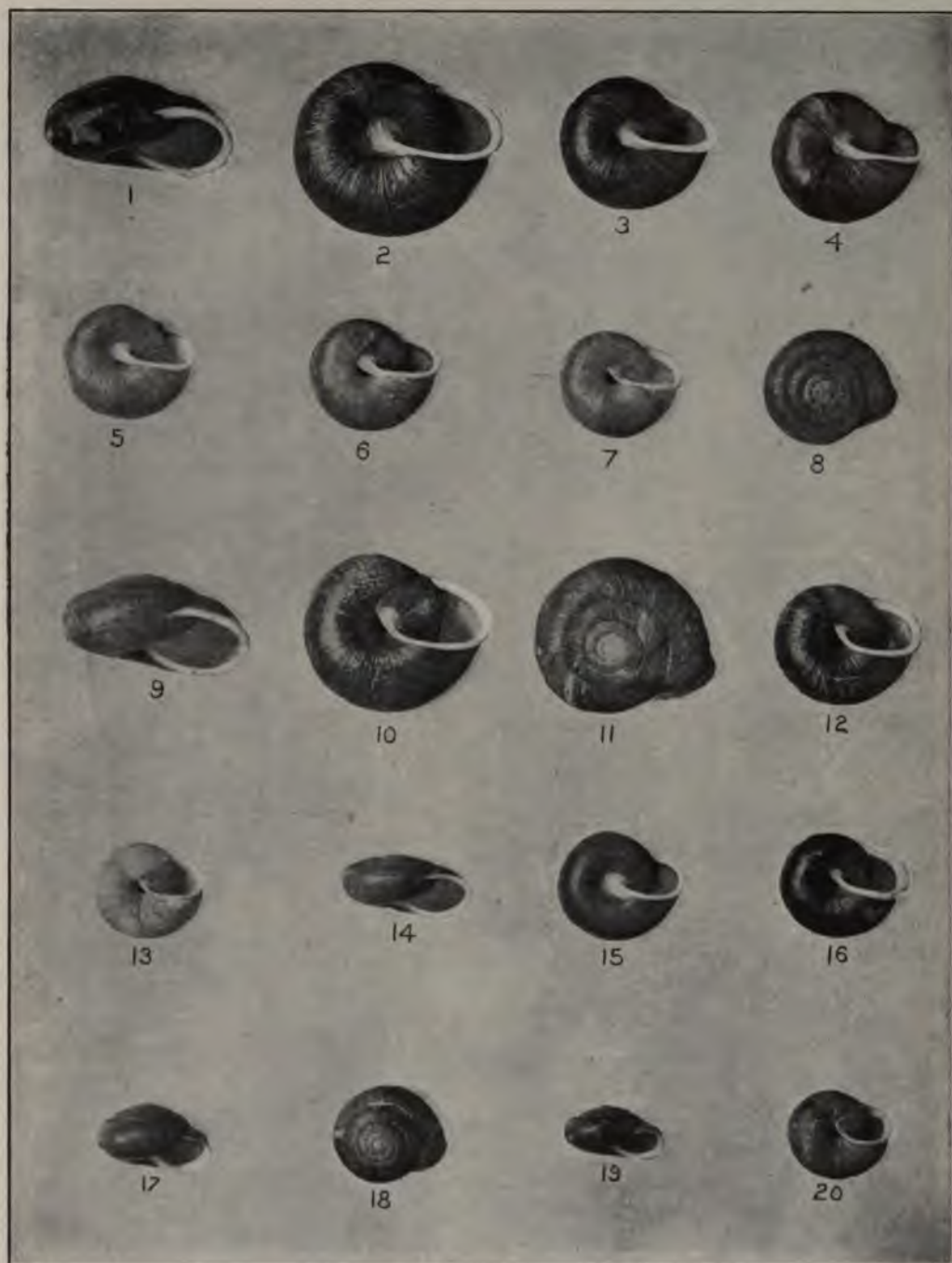








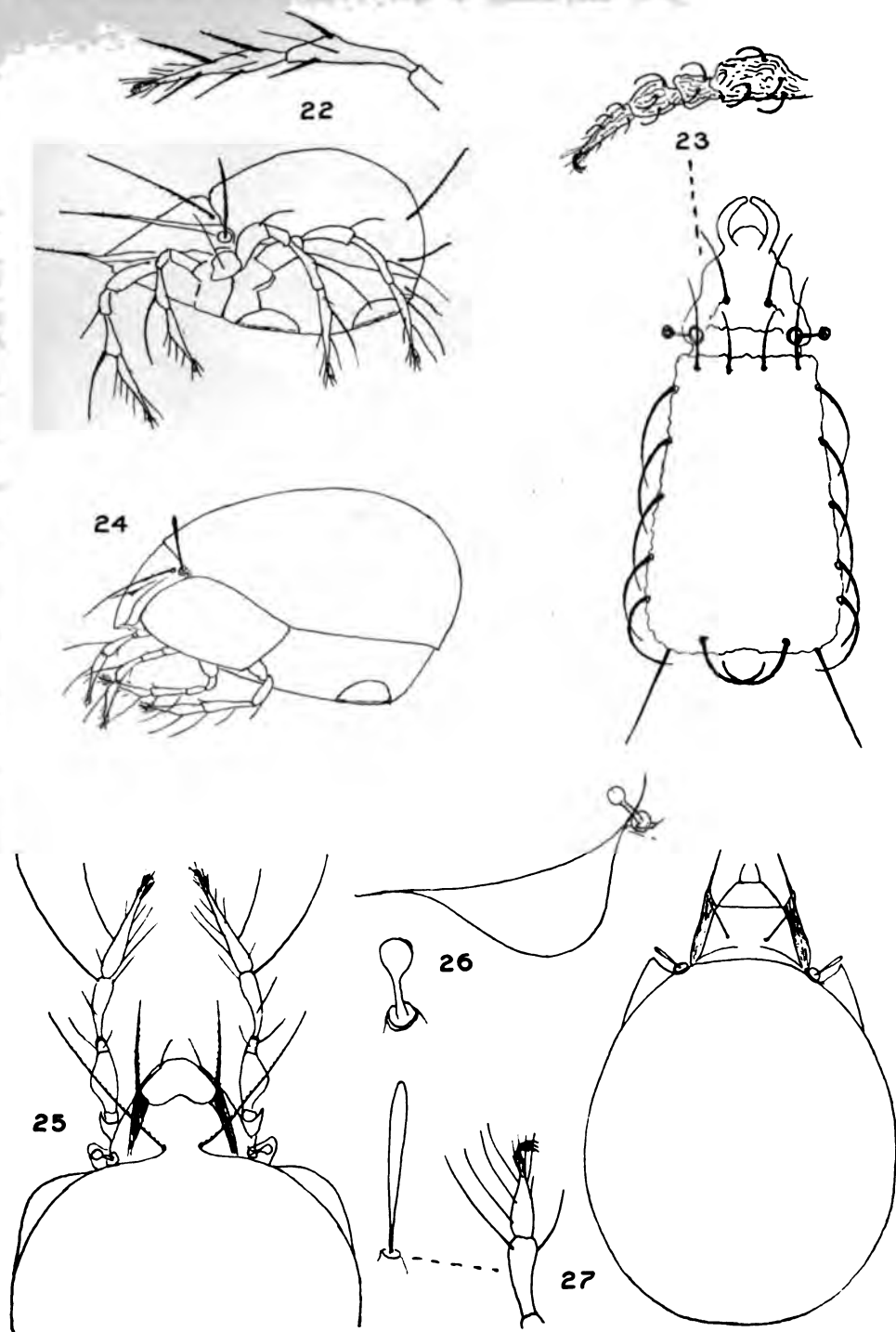




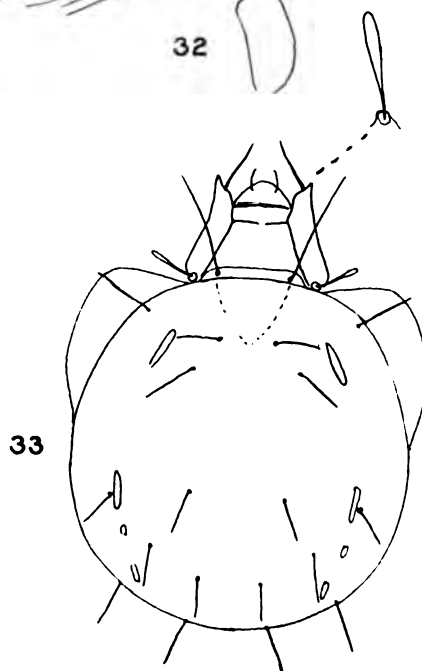
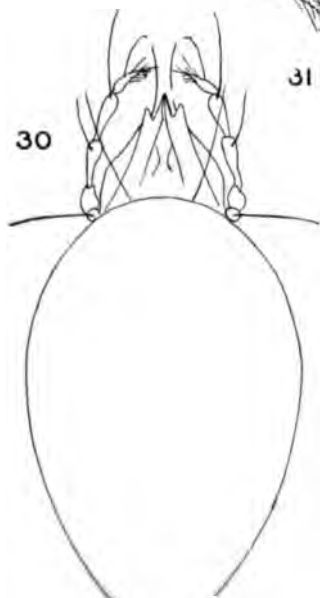
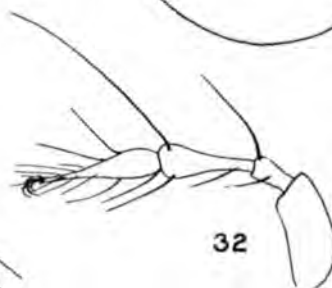
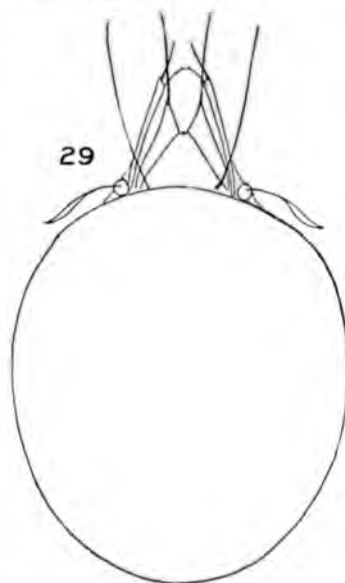
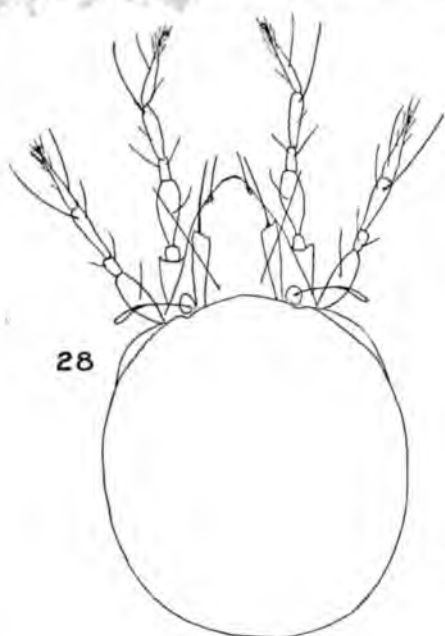
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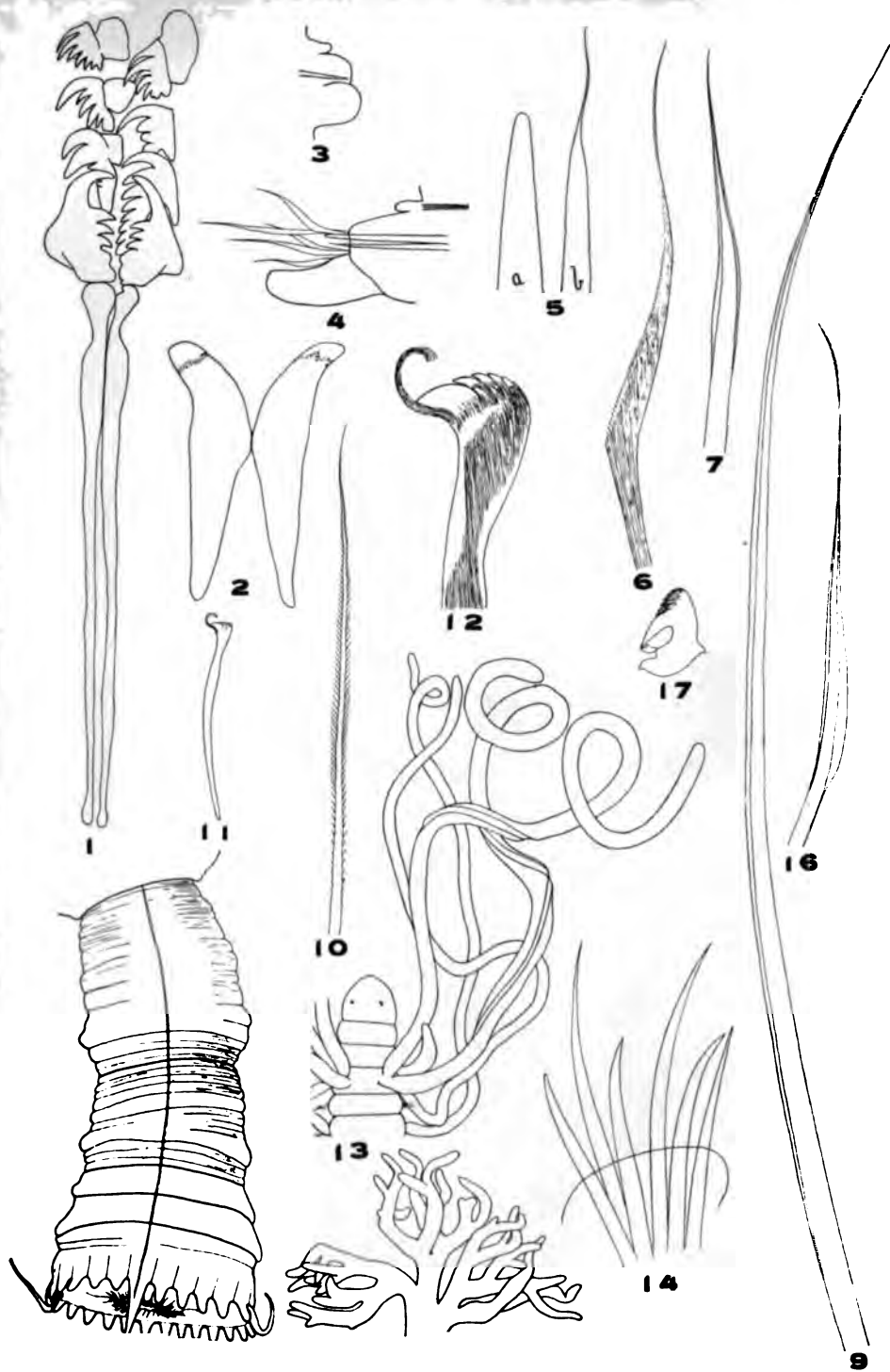




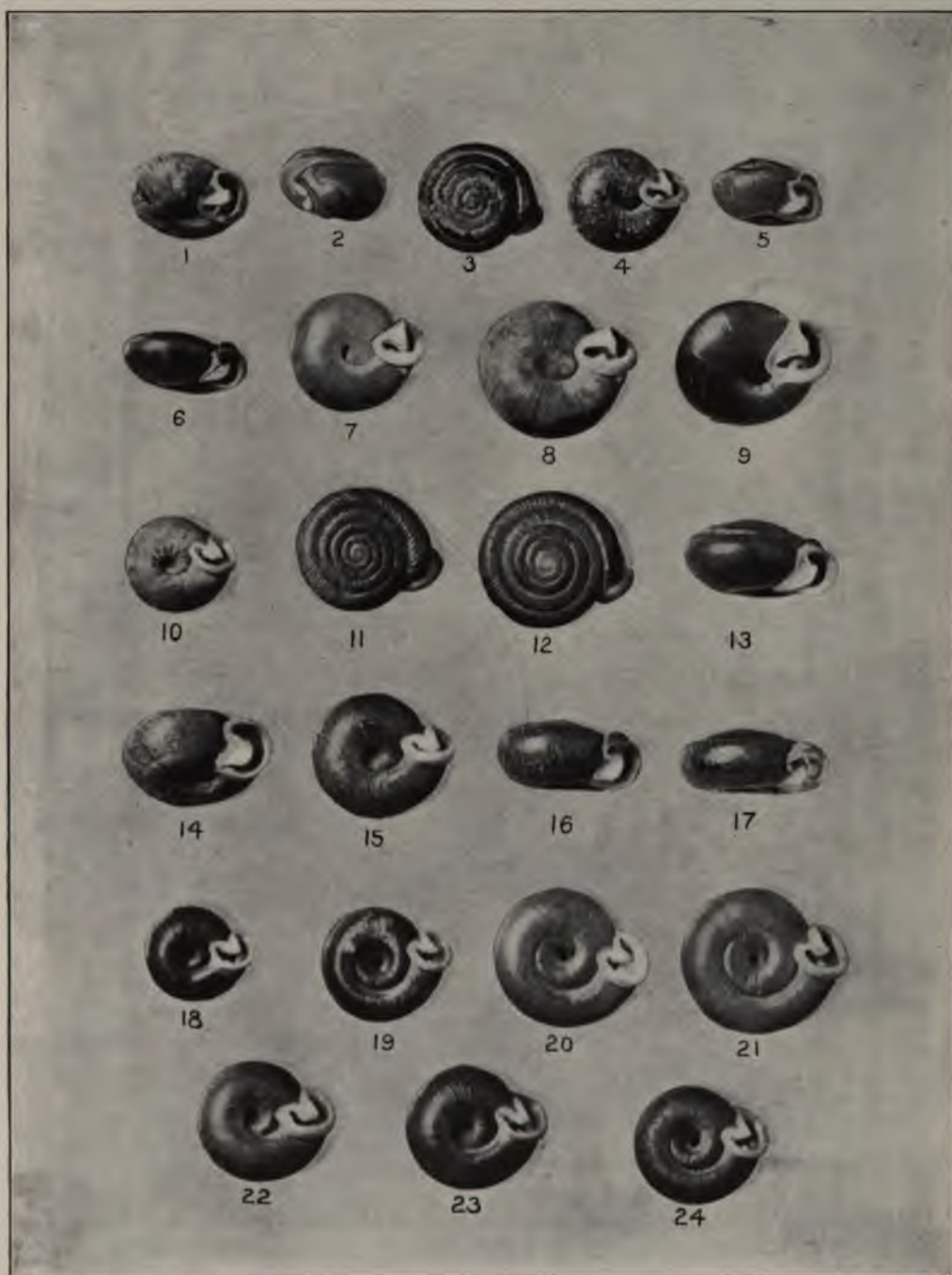






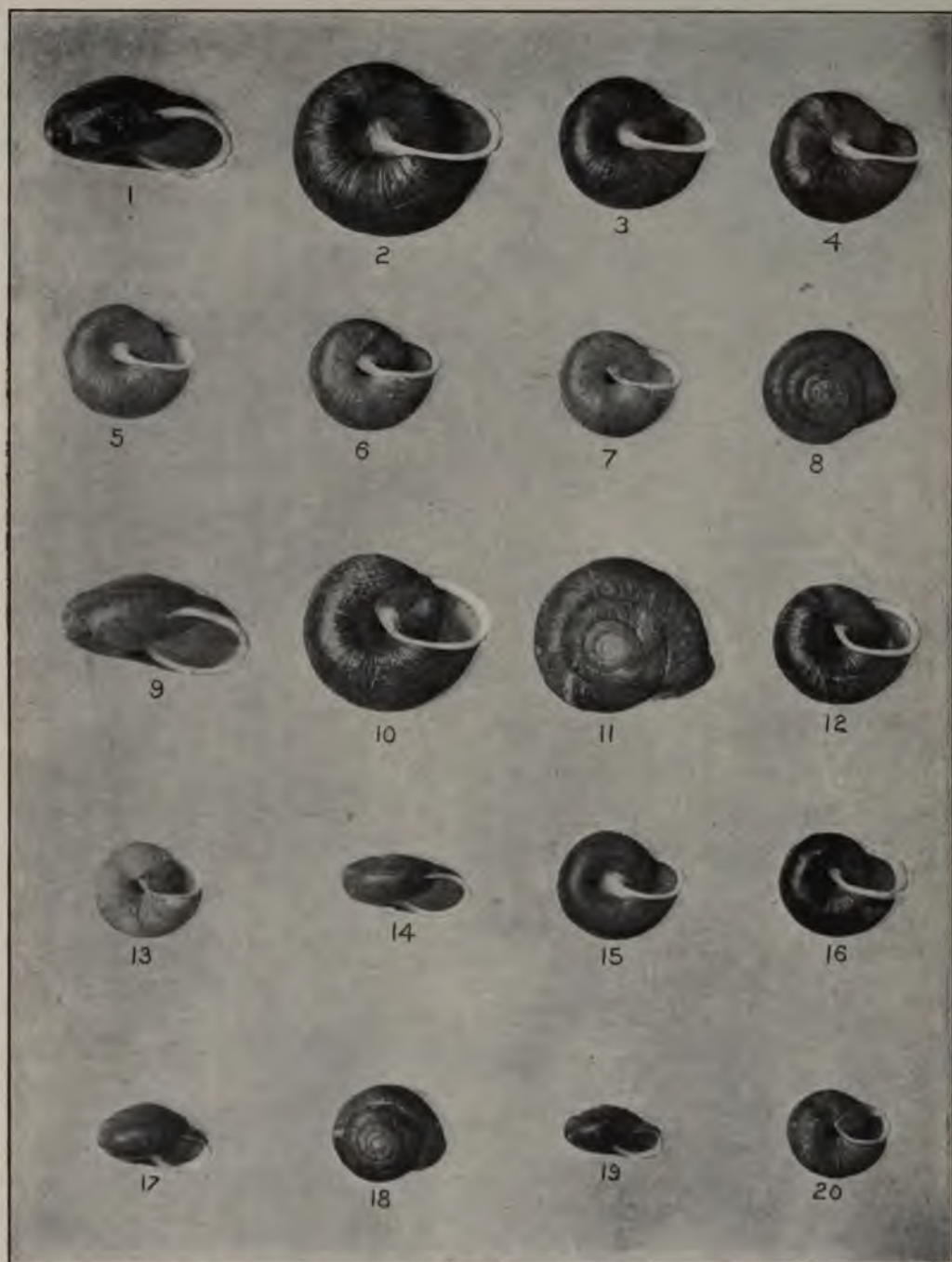






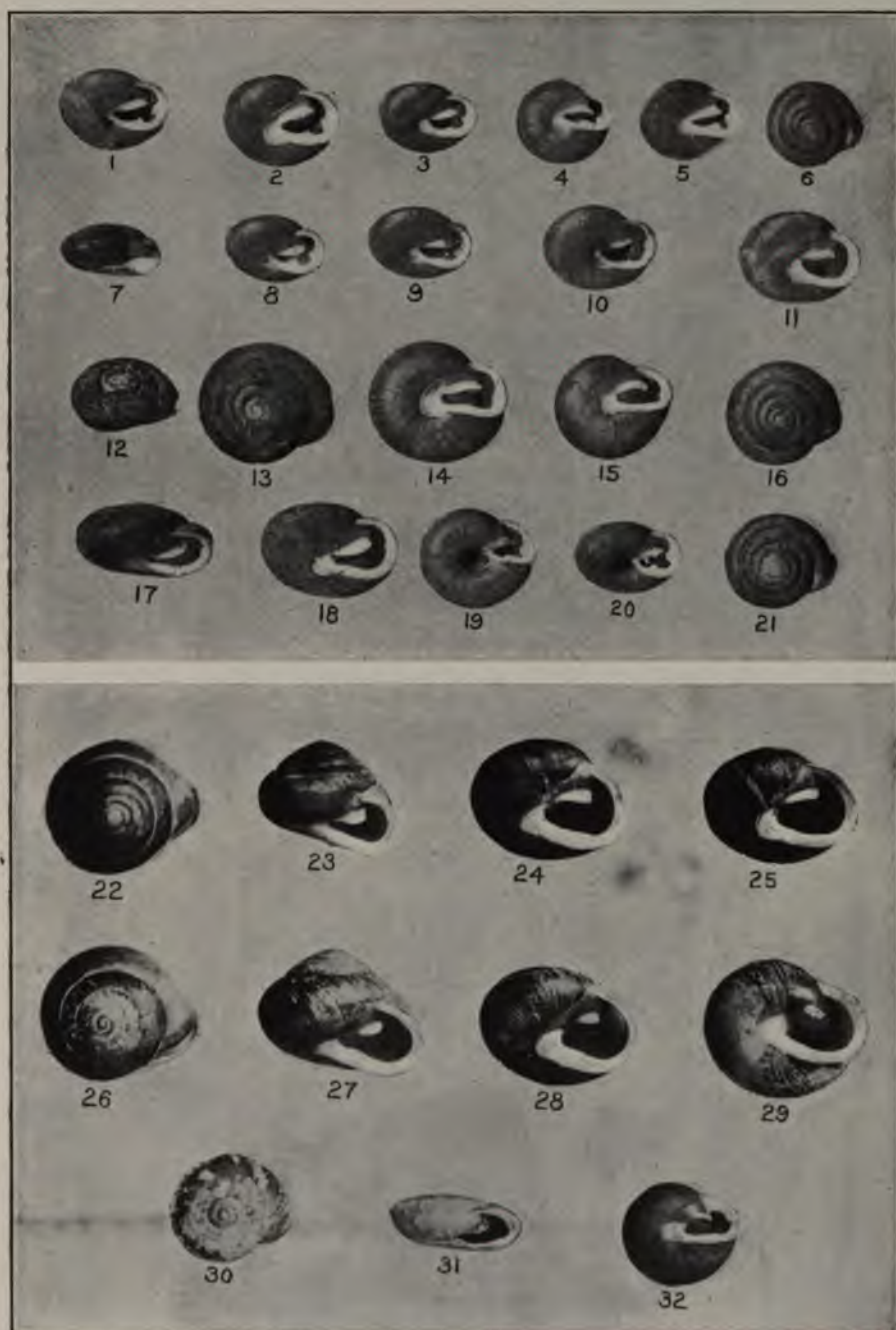






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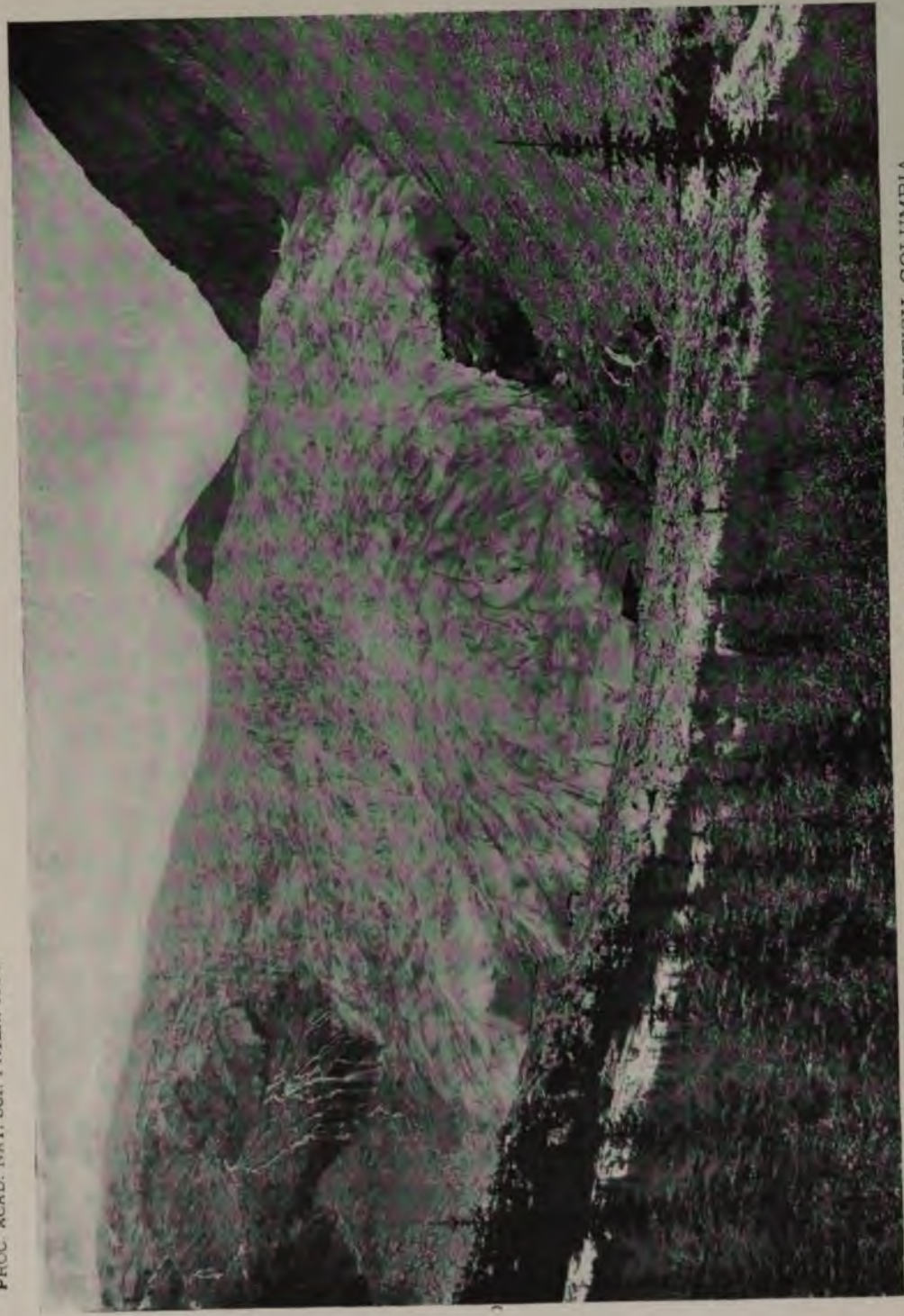
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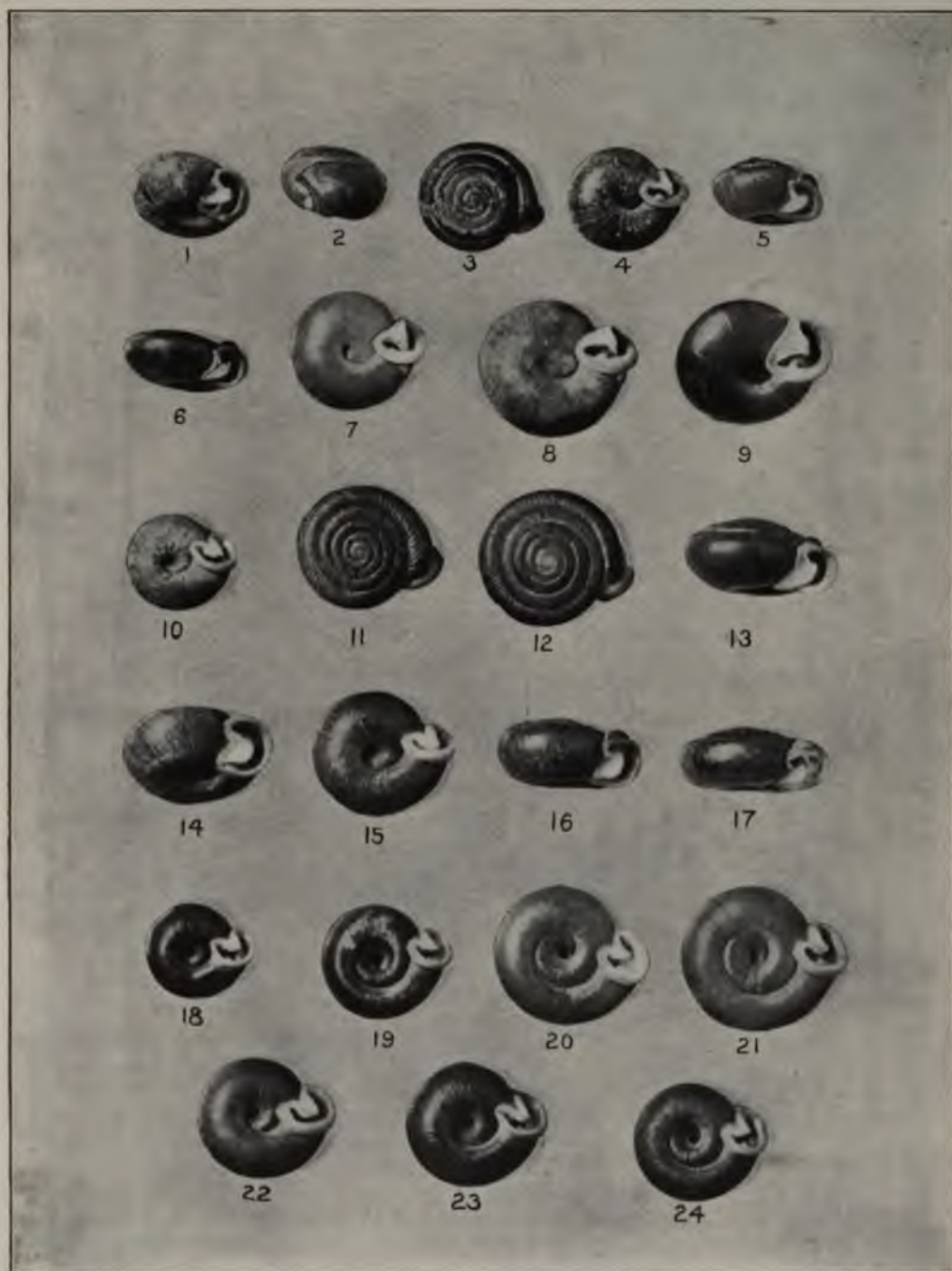


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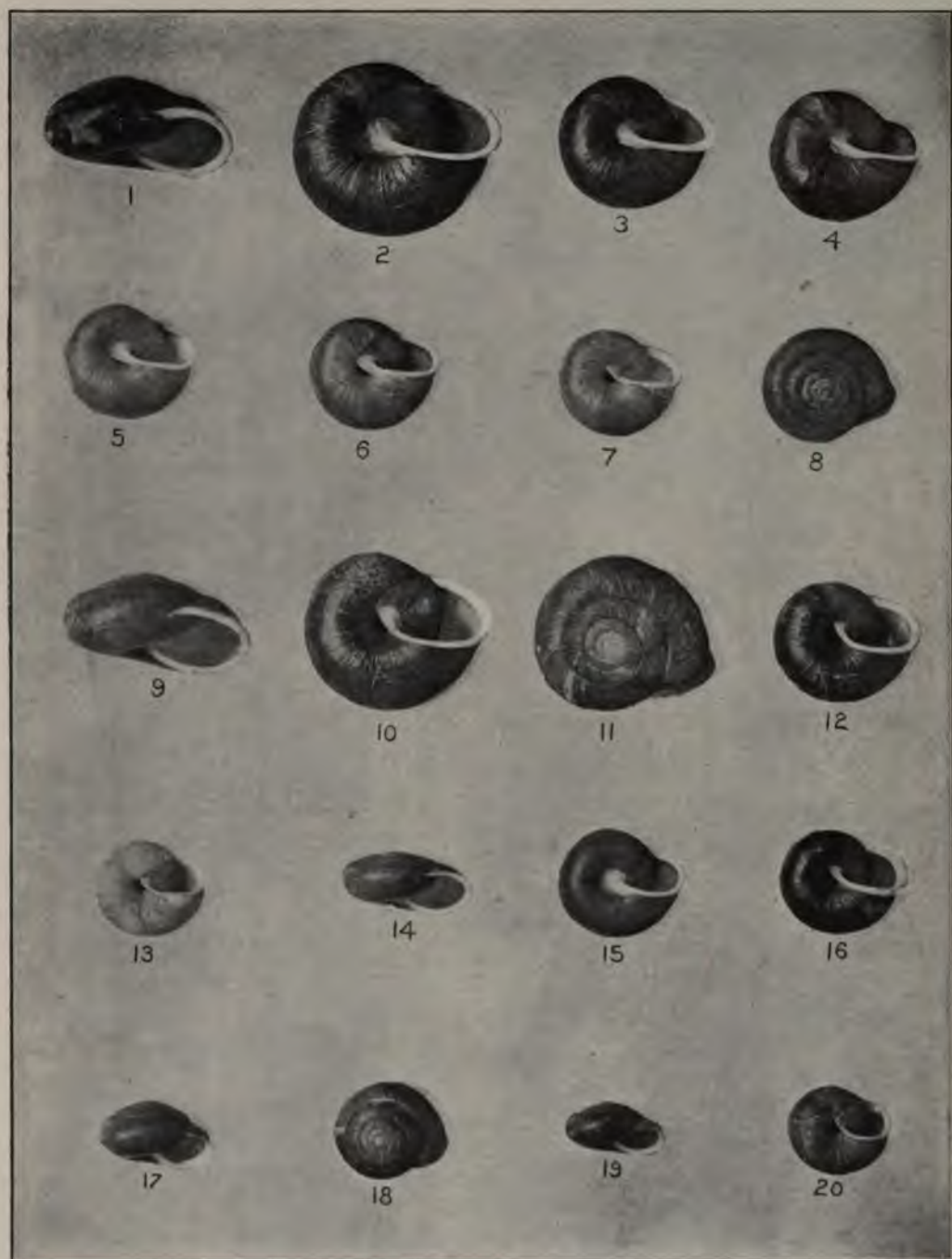
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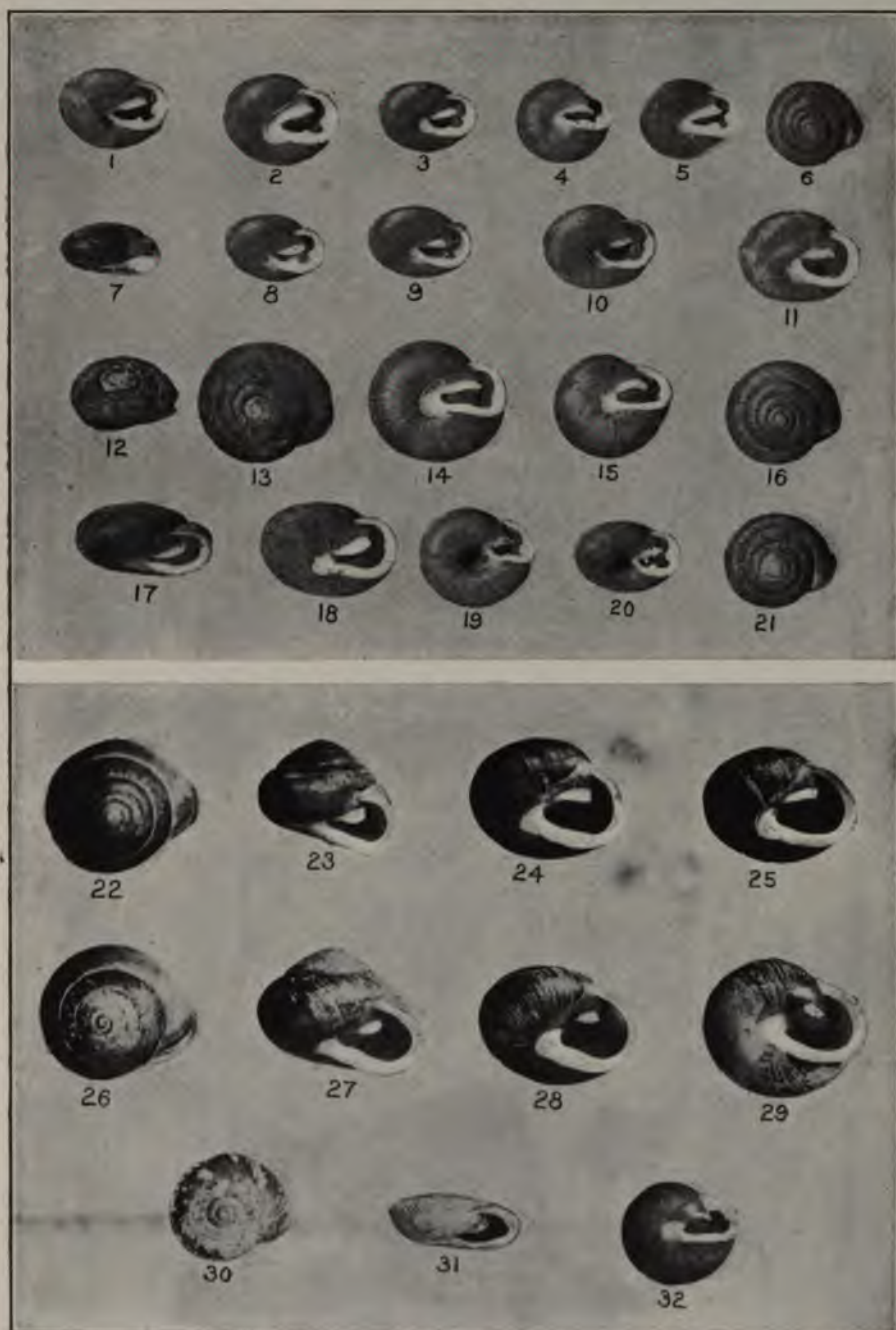






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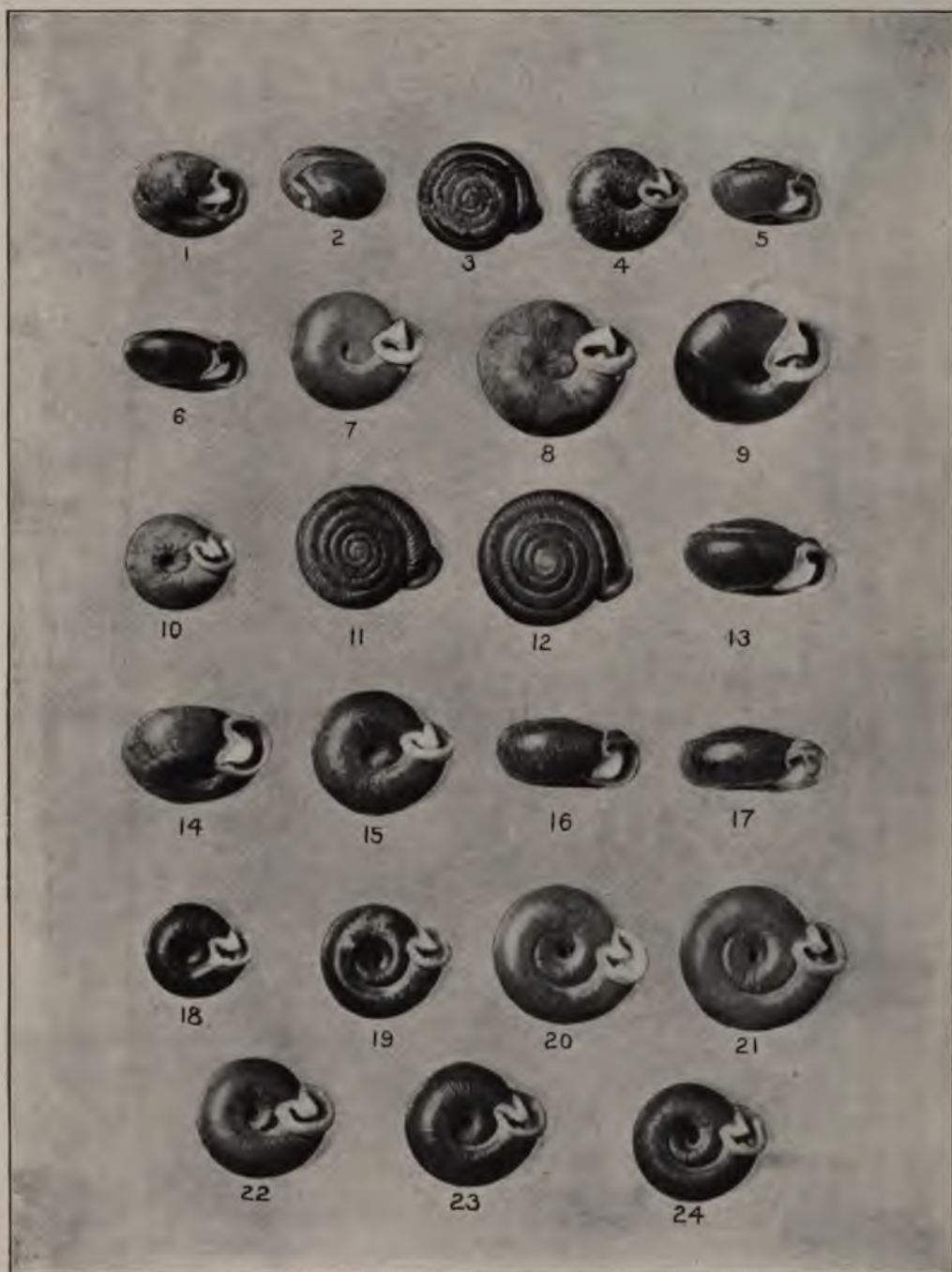
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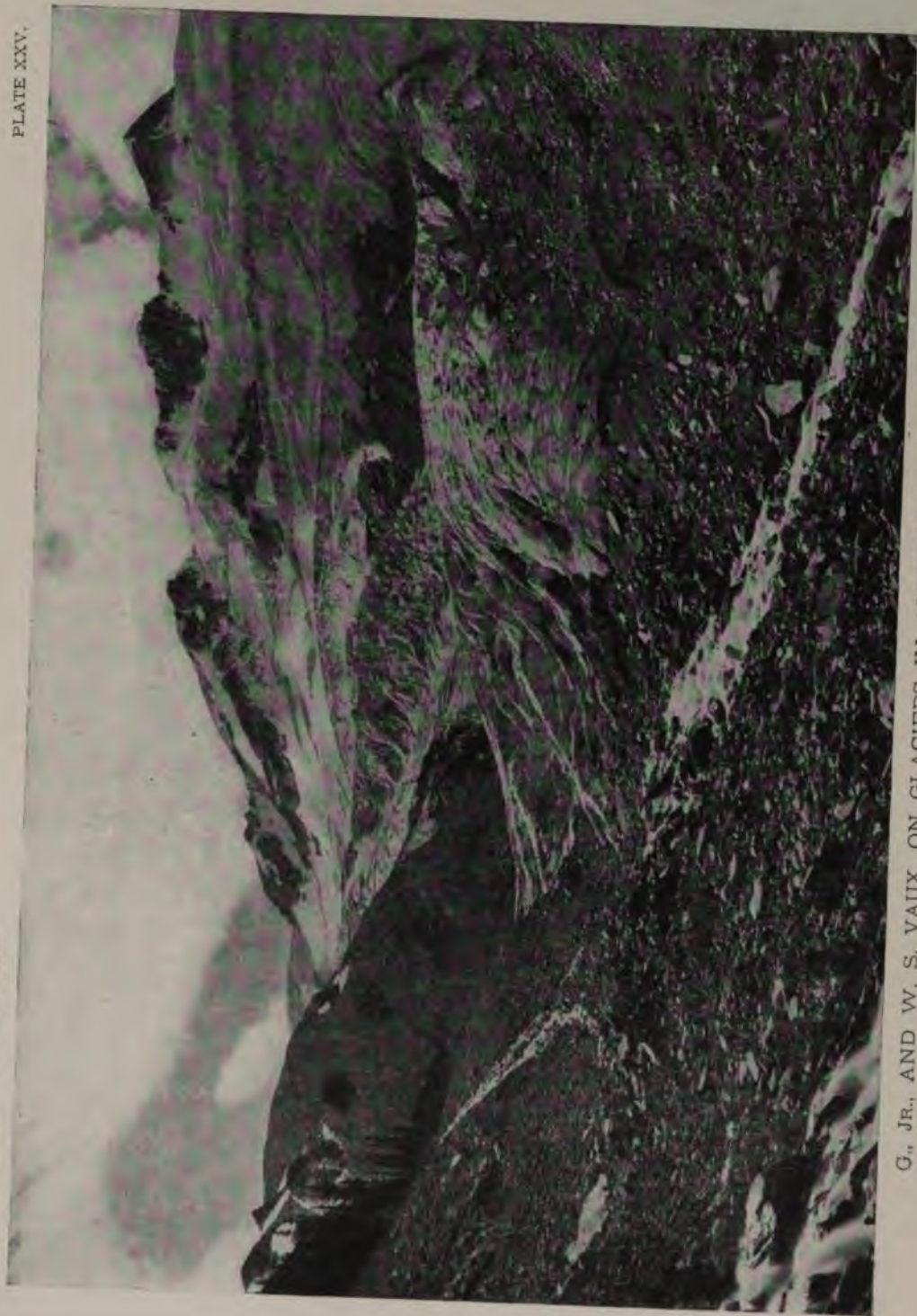












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ASULKAN GLACIER, FROM TEST ROCK, 1902.  
(COMPARE TEST PICTURE OF 1906.)







G. JR., AND W. S. VAUX, ON GLACIERS IN ALBERTA AND BRITISH COLUMBIA.  
ASULKAN GLACIER, FROM TEST ROCK, 1906.

(COMPARE TEST PICTURE OF 1902.)









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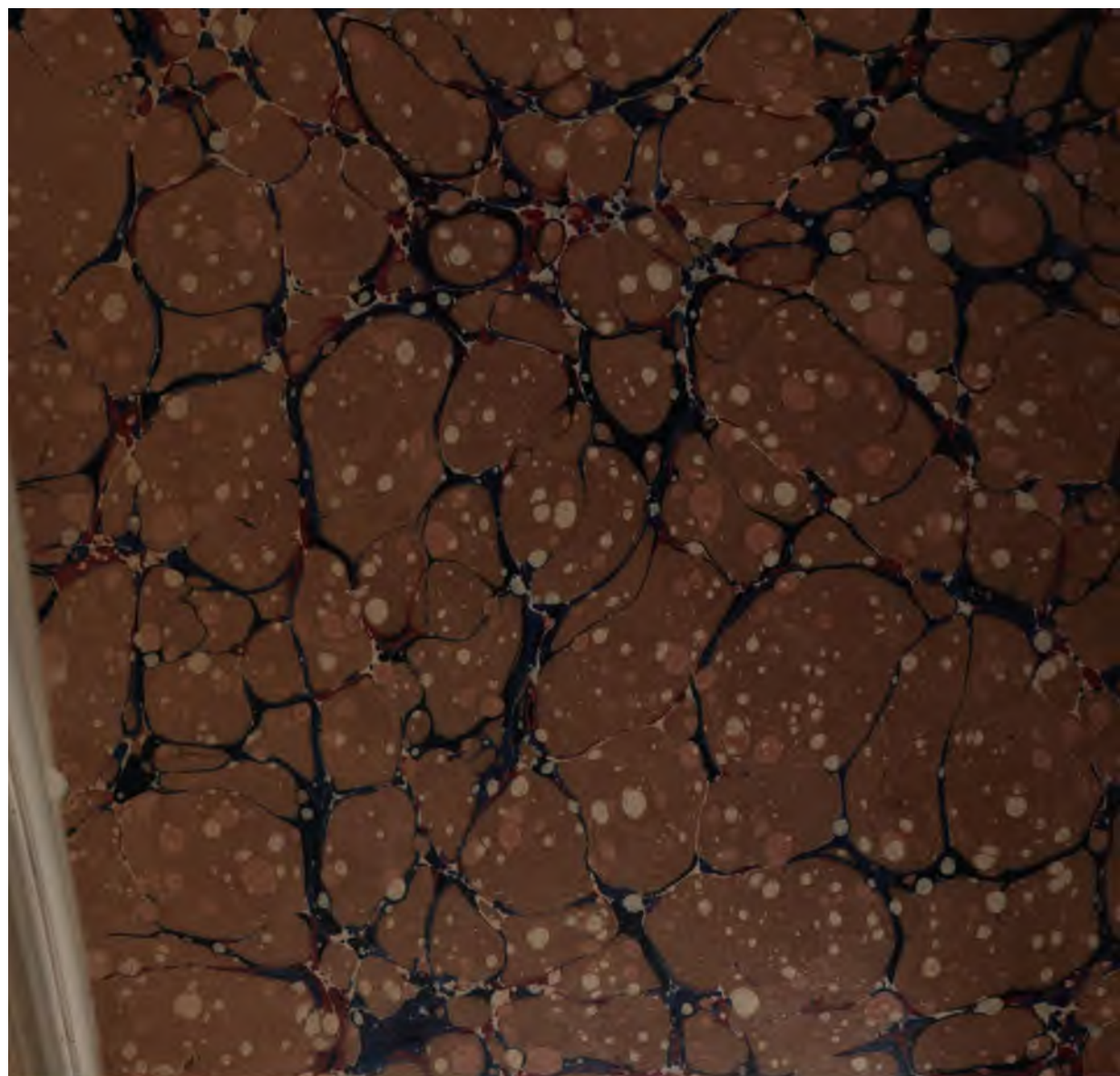
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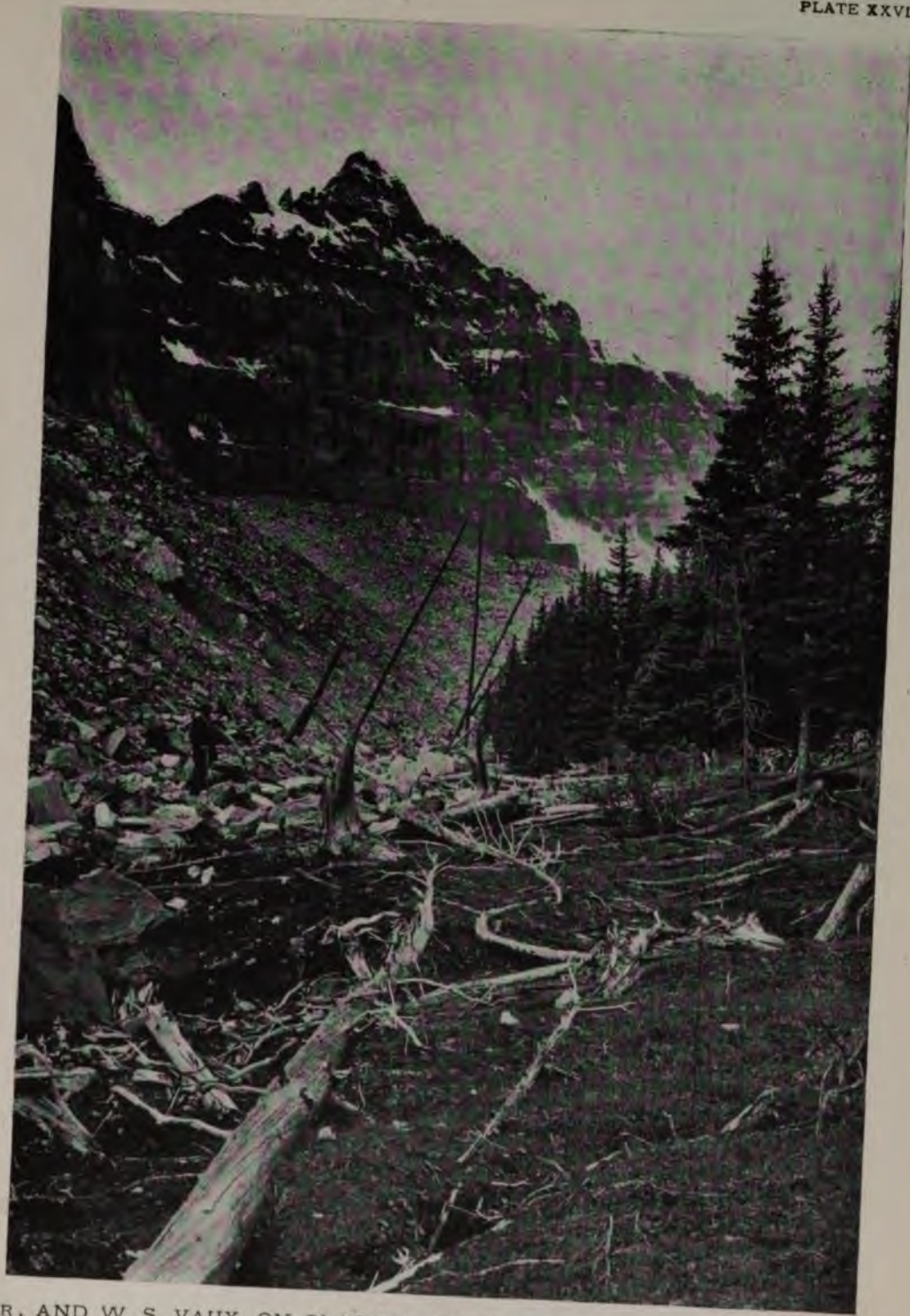




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WENKCHEMNA GLACIER, ALBERTA.  
(SHOWS TERRACE ENGRAINED ON FOREST.)







G. JR., AND W. S. VAUX, ON GLACIERS IN ALBERTA AND BRITISH COLUMBIA.  
WENKCHEMNA GLACIER, ALBERTA.  
(SHOWING MORaine ENCROACHING ON FOREST.)



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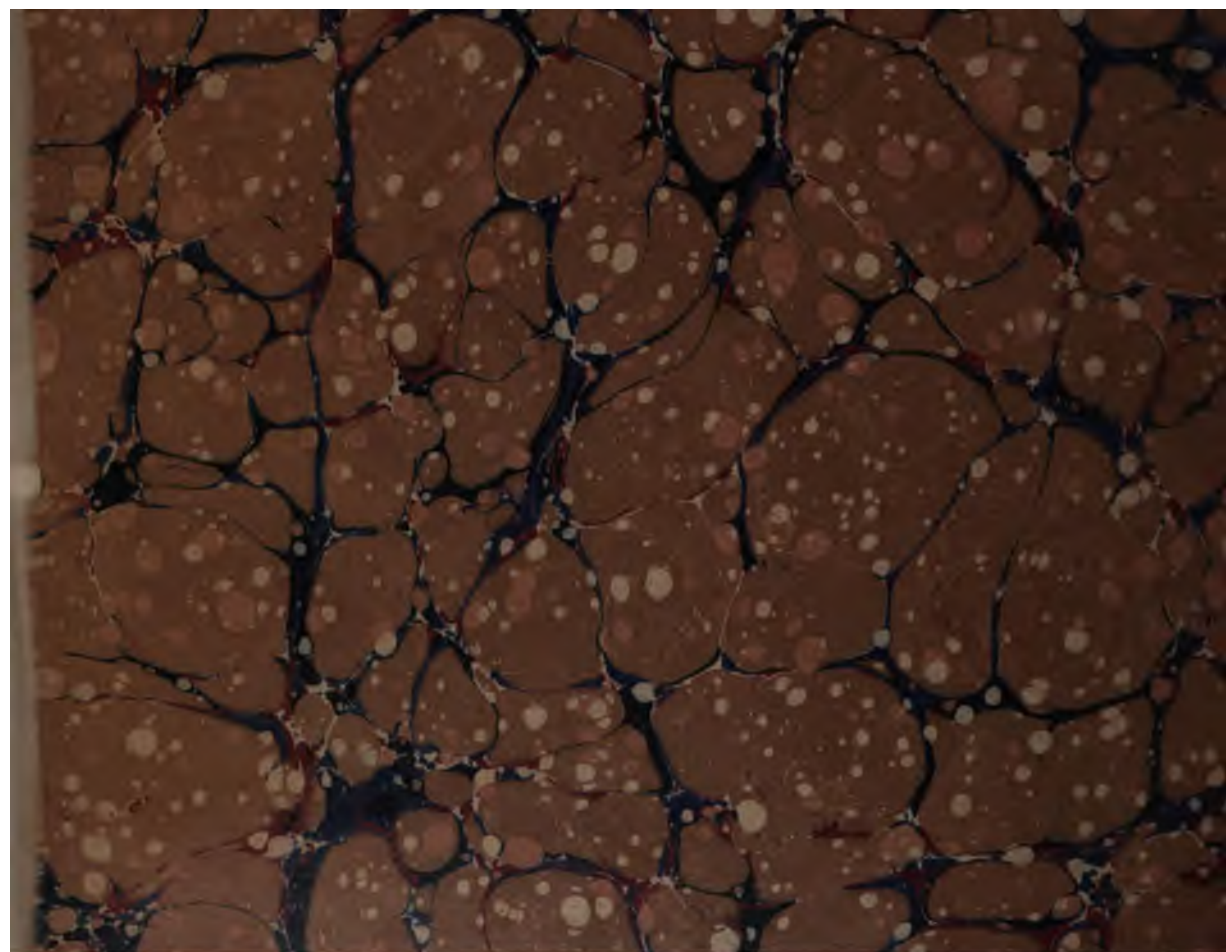
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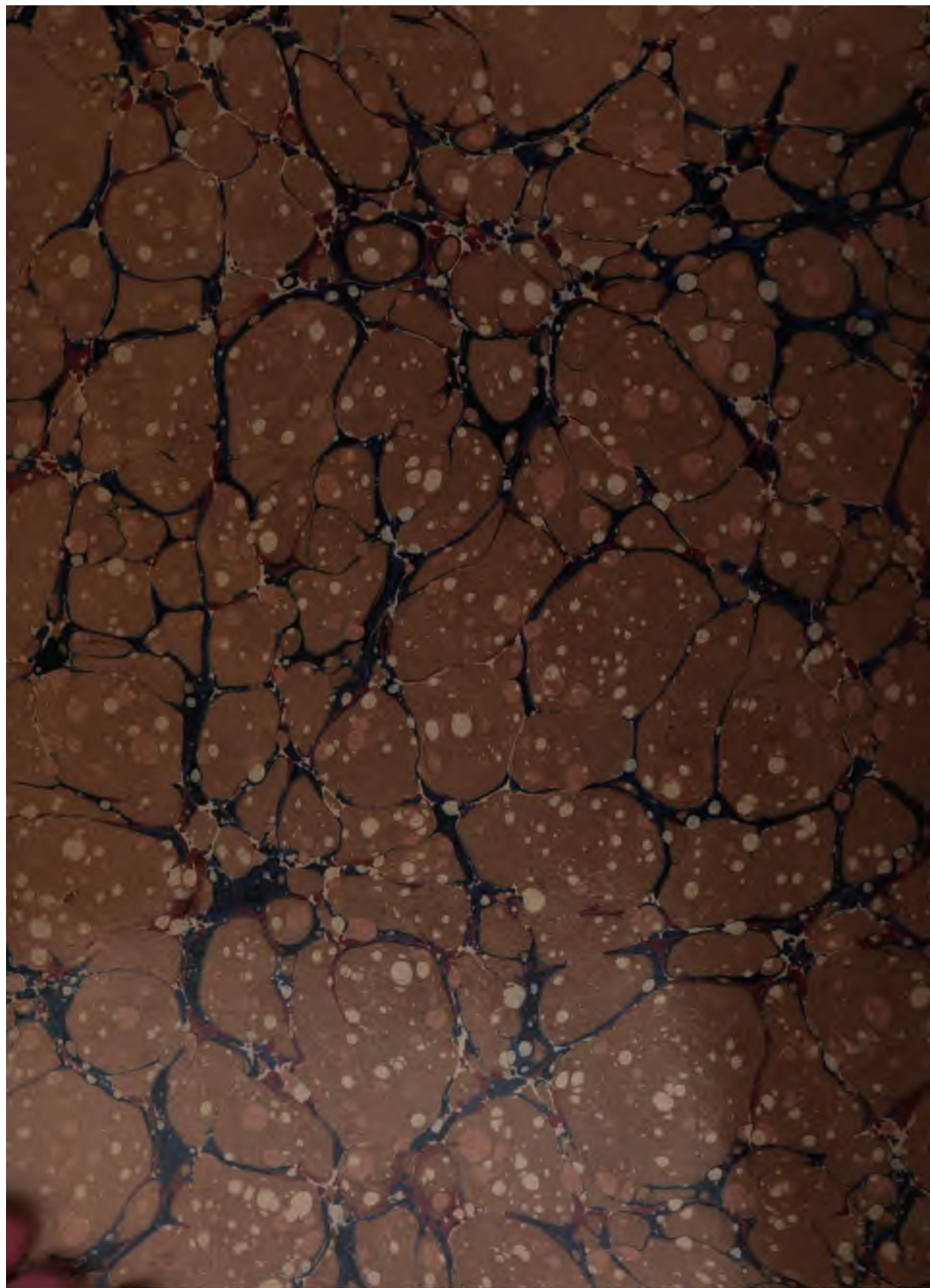












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